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ABSTRACT

This is one of eighteen sets of individualized mathematics problems developed by the Oregon Vo-Tech Math Project. Each of these problem packages is organized around a mathematical topic and contains problems related to diverse vocations. Solutions are provided for all problems. This volume includes problems concerned with computing percents. Problems are drawn from eighteen vocational areas: agriculture, marketing, food processing, clerical work, forest products, forestry, fire and police science, wood products, wastewater technology, industrial mechanics, machine tools, auto mechanics, electronics, diesel mechanics, drafting, industrial, electrical and hydraulics technology, welding, and real estate. (SD)

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ILS INDIVIDUALIZED LEARNING SYSTEMS

Individualized Math Problems in

Percent

Oregon Vo-Tech Mathematics Problem Sets

Retrieval - Dissemination Center
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Individualized Learning Systems

MATHEMATICS

Percent

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Agriculture

A. Problems with solutions.

1. How many lbs. of 9-30-0 (9%N; 30% P_2O_5; K_2O) should one apply to an acre to have an application of 85 lbs of P_2O_5?

Solution: 30% of _____ = 85 lbs

(.30) (_____) = 85 lbs

$$\text{_____} = \frac{85 \text{ lbs}}{.30} = 283 \text{ lbs.}$$

2. 8 lbs of 50% DDT wettable powder were mixed with 100 gallons of water. What percent DDT was in the spray?

Solution: DDT: 50% of 8 lbs = (.50)(8lbs) = 4 lbs.

Water: $(100 \cancel{\text{gals}}) \left(\frac{8.35 \text{ lbs.}}{\cancel{\text{gal}}}\right) = 835$ lbs.

Total: 835 lbs. + 8 lbs = 843 lbs

4 lbs is what % of 843 lbs.

4 = (_____%) (843)

$$\left(\frac{4 \cancel{\text{lbs}}}{843 \cancel{\text{lbs}}}\right) (100) = .4745\%$$

3. If 10,870 pounds of shelled corn containing 32.5% moisture are harvested per acre, how many bushels per acre adjusted to 15.5% moisture were harvested?

Solution:

$$\left(\frac{10{,}870 \text{ lbs}}{\text{acre}}\right) \left(\frac{100\% - 32.5\%}{100\% - 15.5\%}\right) \div \left(\frac{56 \text{ lbs}}{\text{bu/}}\right) =$$

$$\left(\frac{10{,}870 \cancel{\text{lbs}}}{\text{acre}}\right) \left(\frac{67.5\%}{84.5\%}\right) \left(\frac{1 \text{ bu}}{56 \cancel{\text{lbs}}}\right) = 155.1 \text{ bu/acre}$$

4. The recommended fertilizer treatment for a certain 40 acre field is 80 lbs. of Nitrate, 70 lbs, P_2O_5, and 40 lbs K_2O .

a) How many tons of Ammonium Nitrate 33.5%N do we need?
b) How many tons of 0-20-20 and super phosphate 20% P_2O_5 do we need?

Solution:

Total Nitrate needed : $(40 \cancel{\text{acre}}) \left(\frac{80 \text{ lbs}}{\cancel{\text{acre}}}\right) = 3{,}200$ lbs.

Total Phosphate needed: $\left(\frac{70 \text{ lbs}}{\cancel{\text{acre}}}\right) (40 \cancel{\text{acre}}) = 2{,}800$ lbs

Total Potash needed : $\left(\frac{40 \text{ lbs}}{\cancel{\text{acre}}}\right) (40 \cancel{\text{acre}}) = 1{,}600$ lbs.

A. Problems with solutions, continued.

4. Solution (continued)

a. 33.5% of what number = 3,200 lbs

(.335) (_____) = 3,200 lbs

$$\text{_____} = \frac{3{,}200 \text{ lbs}}{.335} = 9{,}552 \text{ lbs or } 4.8 \text{ tons}$$

b. 0-20-20 is 20% P_2O_5 and 20% K_2O therefore using the smaller amount (K_2O) in this case 20% of what number = 1,600 lbs.

(.20) (_____) = 1,600 lbs

$$\text{_____} = \frac{1{,}600 \text{ lbs}}{.20} = 8{,}000 \text{ lbs or } 4 \text{ ton}$$

for 8,000 lbs. K_2O and 8,000 lbs P_2O_5 thus needed (2,800 - 1,600) = 1,200 lbs. P_2O_5 more. 20% of what = 1,200 lbs.

(.20) (_____) = 1,200 lbs

$$\text{_____} = \frac{1{,}200 \text{ lbs}}{.20} = 6{,}000 \text{ lbs or } 3 \text{ ton}$$

Needed:

4.8 ton of 33.5%N, 4 ton of 0-20-20, 3 ton of 0-20-0.

B. Problems without solutions.

5. If a cow needs 2.1 lbs of protein feed per day. How many lbs. of 8% protein feed will she need?

6. In conducting a germination test on seed corn a farmer found that 234 grains out of a total of 257 germinated. What percent germinated?

7. On a tract of land having a 7% slope the vertical interval between two terraces is 8 3/4 ft. How far apart horizontally are the terraces? (slope, when expressed as a percent, is the number of feet of fall per 100 ft. of horizontal distances.)

8. How many tons of ammonium nitrate (53.5%N) will I need for an application of 60 lbs. per acre of Nitrogen on a 275 acre field?

B. Problems without solutions.

9. Average milk is composed (by weight) of 3.75% protein, 3.61% fat, 4.78% lactose, 9.82% ash and water. a.) What percent is water? b.) How many pounds of water are there in a gallon of average milk which weighs 7.97 lbs?

10. In a daily ration for ewes, consisting of 3 3/4 lbs. of alfalfa and 2 1/4 lbs. corn silage, what percent of the ration is alfalfa?

11. How much is freshly cut alfalfa with a 59% moisture content worth, compared to baled alfalfa (selling at $73. per ton) which has a 14% moisture content?

12. a) Which is the cheaper source of total digestable nutrients, barley (78.9% T.D.N.) at $4.97/cwt, or corn (82.7%T.D.N.) at $5.12/cwt.?
b) How much cheaper is it per pound of T.D.N.?

B. Problems without solutions, continued.

13. How many lbs. of 6% gamma BHC wettable powder are needed to make 100 gallons of spray containing 0.03% gamma BHC?

14. What would be the price per pound of dressed weight if you bought a 24-lb. Tom turkey for 24¢/lb. of live weight? (Assume Toms yield 72%).

15. We have 250 steers with average weight of 980 lbs.

a) What is the total selling price at 48¢ a pound based on average weight?
b) What is the total selling price at 3% shrink?
c) If carcass weight is 60% of live weight, what will be the total carcass price at 89¢ per lb. of hanging weight?

B. Problems without solutions, continued.

16. In soil having a dry weight of 87.2 lbs./ft.^{3}, how many inches of rainfall would be needed to increase the moisture content 5% to a depth of 3 ft.?

17. For a ration containing 900 lbs. barley, 300 lbs wheat, 600 lbs. beet pulp, 150 lbs hay, and 50 lbs salt/cal/phos mix determine: a) the digestive protein percent and b) the therms/lb using the data from the following chart:

Feed	Dig. Protein	Net Energy
Barley	6.9%	78 therms/lbs
Wheat	9.5%	81 therms/lbs
Beet Pulp	4.5%	68 therms/lbs
Alfalfa Hay	14.0%	51 therms/lbs

B. Problems without solutions, continued.

18. The recommended fertilizer treatment for a 140 acre field is 90 lbs.N., 100 lbs. P_2O_5, and 40 lbs. K_2O. There are 20 tons of 10-10-10 (which should be completely used up), 10 ton of Ammonium Nitrate, 32% N., 10 ton of Super Phosphate (20% P_2O_5), and 8 ton of 0-30-20 on hand.

a) How many tons of each type fertilizer are needed?

b) To what rate should the fertilizer distributor be set to apply the mixture?

c) What would be the rates if each fertilizer is applied separately?

Complete solutions to B problems.

5. 8% of what no. = 2.1 lbs.

(.08)(_____) = 2.1 lbs.

$$\text{_____} = \frac{2.1 \text{ lbs.}}{.08} = 26.25 \text{ lbs.}$$

6. 234 is what percent of 257

234 = _____% of 257

$$\left(\frac{234}{257}\right)(100) = \text{_____}\% = 91.05\%$$

7. 7% of what no. = 8 3/4 ft.

(.07)(_____) = 8 3/4 ft

$$\text{_____} = \frac{8\ 3/4 \text{ ft}}{0.7} = 125 \text{ ft.}$$

8. Total N needed: (275 ~~acres~~) $\left(\frac{60 \text{ lbs}}{\text{~~acre~~}}\right)$ = 16,500 lbs.

53.5% of _____ = 16,500 lbs.

(.535) (_____) = 16,500 lbs.

$$\text{_____} = \frac{16{,}500 \text{ lbs.}}{.535} = 30{,}841 \text{ lbs.}$$

9. 100% - (3.75% + 3.61% + 4.78% +0.82%)

100% - 12.96% = 87.04%

87.04% of 7.97 = _____

(.8704)(7.97) = 6.94 lbs.

10. Total feed: 3 3/4 lbs + 2 1/4 lbs = 6 lbs.

3 3/4 is _____% of 6

3 3/4 = _____% of 6

$$\frac{3\ 3/4}{6}(100) = \text{_____}\% = 62.5\%$$

11. (2000lbs) (14%) = (2,000lbs) (.14) = 280 lbs moisture
2,000 lbs. - 280 lbs. = 1,720 lbs dry material
59% of what no = 1,720 lbs.
(.59) (_____)= 1,720 lbs.

$$\text{_____} = \frac{1{,}720 \text{ lbs}}{.59} = 2{,}915 \text{ lbs.}$$

(continued)

Complete solutions to B problems.

11. continued

$$\frac{\$73}{(2{,}915\ \text{lbs})\left(\frac{1\ \text{ton}}{2{,}000\ \text{lbs}}\right)} = \frac{\$73}{1.458\ \text{ton}} = \$50.07/\text{ton}$$

12. a.) Barley: 78.9% of 100 lbs = 78.9 lbs. T.D.N.

$$\frac{\$4.97}{78.9\ \text{lbs}} = \$.0630/\text{lb.}$$

Corn: 82.7% of 100 lbs = 82.7 lbs. T.D.N.

$$\frac{\$5.12}{82.7\ \text{lbs}} = \$.0619/\text{lb.}$$

b.) $.0630 - $.0619 = $.0011/lb. or .11¢/lb. (corn cheaper)

13. Amt. pure BHC: $(100\ \text{gallons})\left(\frac{8.35\ \text{lbs}}{\text{gallons}}\right)(0.03\%)$

(100 gals.) (8.35 lbs/gal.) (.0003) = .25 lbs.

Amt. 6% BHC: 6% of what = .25 lbs.

(.06) (_____) = .25 lbs.

$$\text{_____} = \frac{.25\ \text{lbs}}{.06} = 4.17\ \text{lbs.}$$

14. Dressed weight = 72% of live weight = (.72) (24 lbs) = 12.28 lbs.

Total cost: $\left(\frac{24¢}{\text{lb.}}\right)(24\ \text{lbs.}) = \$5.76$

Price/pound dressed = $\frac{\$5.76}{12.28\ \text{lbs.}} = \$.47/\text{lb.}$

15. a.) $(250\ \text{steers})\left(\frac{980\ \text{lbs}}{\text{steer}}\right)\left(\frac{\$.48}{\text{lb.}}\right) = \$117{,}600.$

b.) Selling price - 3% of selling price

$117,600 - (.03) ($117,600) = $117,600 - $3,528 = $ 114,072.00

or another method:

100% - 3% = 97%, (.97) ($117,600) = $114,072.00

c.) $(250\ \text{steers})\left(\frac{980\ \text{lbs}}{\text{steer}}\right)(.60)\left(\frac{\$.89}{\text{lbs}}\right) = \$130{,}830$

Complete solutions tc B problems, continued.

16. Using an area 1 ft square you would have 4 cubic ft. to increase moisture.

$$\left(\frac{87.2 \text{ lbs.}}{\text{cu ft.}}\right)(3 \text{ cu ft.})(.05) = 1308 \text{ lbs}$$

1 ft^3 water equals 62.5 lbs.

$$\frac{13.08 \text{ lbs}}{\left(\frac{62.5 \text{ lbs}}{\text{cu ft.}}\right)} = .209 \text{ cu ft.}$$

but using area of 1 ft^2.

$$\frac{.209 \text{ cu ft}}{1 \text{ sq ft}} = (.209 \text{ ft})\left(\frac{12 \text{ in}}{1 \text{ ft}}\right) = 2.5 \text{ inches}$$

17. a)

(900 lbs)	(6.9%)	= (900lbs)	(.069)	= 62.1 lbs.
(300 lbs)	(9.5%)	= (300 lbs)	(.095)	= 28.5 lbs.
(600 lbs)	(4.5%)	= (600 lbs)	(.045)	= 27.0 lbs.
(150 lbs)	(14.0%)	= (150 lbs)	(.140)	= 21.0 lbs.
(50 lbs)	(0%)	= (50 lbs)	(0)	= 0.0 lbs.
				138.6 lbs dig. protein

138.6 lbs = _____ % of 2,000 lbs.

$$\left(\frac{138.6 \text{ lbs.}}{2{,}000 \text{ lbs.}}\right)(100\%) = \text{_____}\% = 6.93\%$$

b)

(900 lbs)	(78 therms/lb)	=	70,200 therms
(300 lbs)	(81 therms/lb)	=	24,300 therms
(600 lbs)	(68 therms/lb)	=	40,800 therms
(150 lbs)	(51 therms/lb)	=	7,650 therms
(50 lbs)	(0 therms/lb)	=	0 therms
			142,950 therms

$$\frac{142{,}950 \text{ therms}}{2{,}000 \text{ lbs.}} = 71.475 \text{ therms/lb.}$$

Complete solutions to B problems, continued.

18. a) Needed N: (140 ~~acres~~) $\left(\frac{90 \text{ lbs}}{\text{acres}}\right)$ = 12,600 lbs.

P_2O_5: (140 ~~acres~~) $\left(\frac{100 \text{ lbs.}}{\text{acres}}\right)$ = 14,000 lbs.

K_2O : (140 ~~acres~~) $\left(\frac{40 \text{ lbs}}{\text{acres}}\right)$ = 5,600 lbs.

20 ton = 40,000 lbs of 10-10-10 which contains
10% (40,000 lb) = .10 (40,000 lb) = 4,000 lbs of each
Still needed N: 12,600 lbs - 4,000 lbs = 8,600 lbs.

P_2O_5: 14,000 lbs - 4,000 lbs = 10,000 lbs.

K_2O : 5,600 lbs - 4,000 lbs = 1,600 lbs.

For Nitrate use: 32-0-0 32% of _____ = 8,600 lbs.

(.32) (_____) = 8,600 lbs.

(_____) = $\frac{8,600}{.32}$ lbs =
26,875 lbs. or 13.5 ton.

For K_2O start with : 0-30-20

20% of _____ = 1,600 lbs

(.20) (_____) = 1,600 lbs

(_____) = $\frac{1,600}{.20}$ lbs =
8,000 lbs or 4 ton
Gives 1,600 K_2O and 2,400 lbs. P_2O_5 .

Still needed : P_2O_5 10,000 - 2,400 = 7,600 lbs.

20% of _____ = 7,600 lbs.

(.20) (_____) = 7,600 lbs.

(_____) = $\frac{7,600}{.20}$ lbs =
38,000 lbs or 19 ton

Thus needed: 13.5 ton 32-0-0

20. ton 10-10-10

4. ton 0-30-20

19. ton 0-20-0

Total 56.5 ton

Complete solutions to B problems, continued.

18 continued.

b) $\left(\frac{56.5 \text{ ton}}{140 \text{ acres}}\right)\left(\frac{2{,}000 \text{ lb}}{\text{ton}}\right) = 807 \text{ lbs/acre}$

c) 10-10-10 $\left(\frac{20 \text{ ton}}{140 \text{ acres}}\right)\left(\frac{2{,}000 \text{ lbs}}{\text{ton}}\right) = 286 \text{ lbs./acre}$

32-0-0 $\left(\frac{13.5 \text{ ton}}{140 \text{ acres}}\right)\left(\frac{2{,}000 \text{ lbs}}{\text{ton}}\right) = 193 \text{ lbs./acre}$

0-30-20 $\left(\frac{4 \text{ ton}}{140 \text{ acres}}\right)\left(\frac{2{,}000 \text{ lbs.}}{\text{ton}}\right) = 57 \text{ lbs./acre}$

0-20-0 $\left(\frac{19 \text{ ton}}{140 \text{ acres}}\right)\left(\frac{2{,}000 \text{ lbs}}{\text{ton}}\right) = 271 \text{ lbs./acre}$

A. Problems with Solutions

1. A merchant received $60 for a machine that cost him $24. If the selling expense amounted to 25 percent of the cost price, the profit was what percent of the selling price?

Solution:

The selling expense is the money it costs the businessman to handle the machine. The cost price is what he paid for the machine.

Selling expense = ($24.00)(25%) = ($24.00)(0.25) = $6.00

Profit = Selling price - cost - selling expense

Profit = $60.00 - ($24.00 + $6.00)

= $60.00 - $30.00 = $30.00

Percent of selling price = $\frac{\$30}{\$60}$ = 0.50 = 50%

2. If an article that costs $16 is sold for $24.50, the profit is what (a) percent of the cost, (b) what percent of the selling price?

Solution:

Profit = selling price - cost

Profit = $24.50 - $16.00 = $8.50

(a) Profit as percent of cost = $\frac{\$8.50}{\$16.00}$ = 0.53 = 53%

(b) Profit as percent of selling price = $\frac{\$8.50}{\$24.50}$ = 0.35 = 35%

3. A realtor purchased a house for $16,400. After spending $560 on improvements, he sold it for 120% of the purchase price. What was his profit?

Solution:

Total amount invested by realtor = $16,400 + $560 = $16,960

Sales price = ($16,400)(120%) = ($16,400)(1.20) = $19,680

Profit = $19,680 - $16,960 = $2,720

A. Problems with Solutions (continued)

4. The Fashion Shop reduced their fall coats in a post-holiday sale by 8 1/3% of the marked price. These coats originally sold for $65.00. What was the actual selling price?

Solution:

Amount of reduction = ($65.00)(8 1/3%)

= ($65.00)(0.08333) = $5.42

New selling price = $65.00 - $5.42 = $59.58

Note: (65)(0.0833) = 5.41
(65)(0.08333) = 5.42

Point: Use as many decimal digits in the decimal equivalent of a fractional percent as is needed to get the maximum dollar value.

B. Problems without Solutions

5. A grocer purchased 25 crates of berries for 70¢ each. If a crate was lost through spoilage, at what price per crate did he sell the remainder to gain at least a 35% profit?

6. A machine costing $800 will have a scrap value of 25% at the end of 8 years. Find the yearly depreciation charge by the straight-line method. (The straight-line method means it will depreciate the same amount each year.)

B. Problems without Solutions (continued)

7. A man who was thinking of buying a piece of property found the assessed value to be $3,000. If the average assessed value of property in the town was about 60 percent of the real value, about what was the property worth?

8. A merchant feels that, by an intensive campaign of advertising and service for 5 years, he can increase his sales each year 10 percent over the previous year's sales. If his sales were $130,000 for the year before the campaign started and the campaign was successful, how much would the sales be for the last year?

9. The monthly income from a building is $475.00. Yearly operating expenses amount to $1,867.00. If the owner receives a 10% annual return on his investment, how much did the building cost?

B. Problems without Solutions (continued)

10. Harold Hurst, an apple grower, shipped 670 boxes of apples to the Central State Produce Company, commission merchants, to be sold on a commission of 16 1/2%. The apples were sold at $3.50 a box. Insurance was 1/2% of gross sales. Transportation charges amounted to $92.05. Find the net proceeds.

11. Harland & Co. purchased the following produce for the Newton Grocers: 80 sacks of potatoes @ $4.25; 125 sacks of onions @ $3.25; 60 sacks of onions @ $2.00 (prices are per sack). Transportation charges amounted to $22.70. Insurance charges were 1/2% of the prime cost (cost of produce). Harland and Co. received a 14% commission based on the prime cost of the merchandise. How much did this transaction cost Newton Grocers?

12. A sports store has reduced the price of a boat on three different occasions in an effort to sell it. The original price was $805.70, and the three reductions were marked as 25%, 16 2/3% and 10% in that order. What is the final selling price?

B. Problems without Solutions (continued)

13. A machine was sold at a profit of $17.60 which was 16 percent of the cost. What was the selling price of the machine?

14. Sales decreased from $36,000 to $31,500 during a certain period of time. What rate of decrease did this represent (nearest tenth of 1%)?

15. A retail store manager bought a bill of goods at a cost of $850 less 25% and 5%. If it was sold for 12 1/2% more than the net cost, what was the selling price?

16. At what price should an article costing $5.20 be marked in order to allow a 2% discount for cash and make a profit of 25% of cost?

B. Problems without Solutions (continued)

17. Zane Brothers purchased a selection of Floor lamps at a net price of $875 which were listed by the wholesaler at $1,250. What was the rate of discount?

18. A suit which costs $66.50 sells for $95.00. What is the percent markup based on (a) cost, (b) selling price?

19. Mrs. Romine bought 20 suits at $30.00 each. She sold 12 at $47.50 each; 3 were soiled and sold for $35.00 each. At what price must she sell the remainder to make a gross profit of 40% on total cost?

20. A gas stove sells for $260. If operating expenses are 30% of sales and net profit is 8% of sales, what is the cost of the stove?

Complete Solutions to B Problems

5. Total cost = (25 crates)($0.70/crate) = $17.50

Number of good crates = 25 crates - 1 crate = 24 crates

Profit he wishes to make = ($17.50)(35%) = ($17.50)(0.35) = $6.13

Selling price to cover profit = $\frac{\$17.50 + \$6.13}{24 \text{ crates}}$

$= \frac{\$23.63}{24 \text{ crates}} = \$0.9846/\text{crates}$

Notice that if he sells the crates for $0.98 each, his total income is (24 crates)($0.98/crates) = $23.52 which is $0.11 short of his goal! Since rounding off $0.9846 to $0.98 causes the grocer to be below his goal, he must round up to $0.99, thus making $0.13 over the desired profit level.

6. Total drop in value = ($800)(75%) = ($800)(0.75) = $600

Depreciation = $600/8 yr = $75/year

7. (Real value)(0.60) = $3,000

Real value = $\frac{\$3,000}{0.60} = \$5,000$

8. First year's sales = ($130,000)(1.10) = $143,000

Second year's sales = ($143,000)(1.10) = $157,300

Third year's sales = ($157,300)(1.10) = $173,030

Fourth year's sales = ($173,030)(1.10) = $190,333

Fifth year's sales = ($190,333)(1.10) = $209,366.30

9. Yearly income = ($475/month)(12 months/year) = $5,700/year

Annual return = $5,700 - $1,867 = $3,833

(Cost)(0.10) = $3,833

Cost = $\frac{\$3,833}{0.10} = \$38,330$

Complete Solutions to B Problems (continued)

10. Net Proceeds = gross sales - expenses

Gross sales = (670 boxes)($3.50/box) = $2,345.00

Expenses = commission charge + insurance + transportation

= (16 1/2%)(gross sales) + (1/2%)(gross sales) + $92.05

= (0.165)($2,345.00) + (0.005)($2,345.00) + $92.05

= $386.93 + $11.73 + $92.05

= $490.71

Net proceeds = $2,345.00 - $490.71 = $1,854.29

11. Grocer's cost = prime cost + (14%)(prime cost) + (1/2%)(prime cost) + transportation

Prime cost = (80 sacks)($4.25/sack) + (125 sacks)($3.25/sack) + (60 sacks)($2.00/sack)

= $340.00 + $406.25 + $120.00

= $866.25

Grocer's cost = $866.25 + (0.14)($866.25) + (0.005)($866.25) + $22.70

= $866.25 + $121.28 + $4.33 + $22.70

= $1,014.56

12. To get the final selling price, figure each percent reduction and subtract the reduction.

Selling price after:

First reduction $805.70 - ($805.70)(0.25) = $805.70 - $201.425
= $604.28

Second reduction $604.28 - ($604.28)(0.1666) = $604.28 - $100.71
= $503.57

Final reduction $503.57 - ($503.57)(0.10) = $503.57 - $50.357
= $453.21

Complete Solutions to B Problems (continued)

13. (cost)(16%) = $17.60

(cost)(0.16) = $17.60

$$\text{Cost} = \frac{\$17.60}{0.16} = \$110.00$$

Selling price = cost + profit

Selling price = $110.00 + $17.60 = $127.60

14. $$\text{Rate of decrease} = \frac{\$36{,}000 - \$31{,}500}{\$36{,}000} = \frac{\$4{,}500}{\$36{,}000} = 0.125 = 12.5\%$$

15. First find the net cost.

Cost after first discount = $850.00 - ($850.00)(0.25)

= $850.00 - $212.50 = $637.50

Net cost = $637.50 - ($637.50)(0.05)

= $637.50 - $31.875

= $605.63

Selling price = $605.63 + (0.125)($605.63)

= $605.63 + $75.70 = $681.33

16. When you discount the selling price by 2%, you are left with 98% of the selling price. So, (selling price)(98%) = cost + (cost)(25%)

(selling price)(0.98) = $5.20 + ($5.20)(0.25)

(selling price)(0.98) = $5.20 + $1.30

(selling price)(0.98) = $6.50

$$\text{Selling price} = \frac{\$6.50}{0.98} = \$6.63$$

Complete Solutions to B Problems (continued)

17. Amount of discount = $1,250 - $875 = $375

Rate of discount = $\frac{\$375}{\$1,250}$ = 0.30 = 30%

18. Total markup = selling price - cost

= $95.00 - $66.50

= $28.50

(a) Percent of cost = $\frac{\$28.50}{\$66.50}$ = 0.43 = 43%

(b) Percent of selling price = $\frac{\$28.50}{\$95.00}$ = 0.30 = 30%

19. Figure out the total cost, get 40% of this cost, then see how much is needed to meet this goal.

total cost = (20 suits)($30.00/suit) = $600.00

= ($600.00)(0.40)

= $240.00

Total selling price = cost + profit

= $600.00 + $240.00 = $840.00

Income so far = (12 suits)($47.50/suit) + (3 suits)($35.00/suit)

= $570.00 + $105.00 = $675.00

From the remaining suits, Mrs. Romine needs to receive:

$840.00 - $675.00 = $165.00

Sales price for remaining suits = $\frac{\$165.00}{5 \text{ suits}}$ = $33.00/suit

20. Cost = selling price - (profit + expenses)

Cost = $260.00 - [(0.08)($260.00) + (0.30)($260.00)]
= $260.00 - ($20.80 + $78.00)
= $260.00 - $98.80
= $161.20

A. Problems with Solutions

1. Your swing shift produces 20,000 - 2 1/2 lb packages of frozen sweet corn. One hundred tons of sweet corn in the husk were pushed into the conveyors during this shift. Was your percent of recovery good? (Refer to table 10.)

   Solution:

   $$\text{Recovery} = (20{,}000 \text{ cans})(2.5 \text{ lb/can}) = 50{,}000 \text{ lbs}$$

   $$\text{Percent recovery} = \frac{\text{recovery}}{\text{original}} = \frac{50{,}000 \text{ lbs}}{200{,}000 \text{ lbs}} = 25\%$$

   The percent of recovery was good because the 25% recovery is 1% over the anticipated 76% loss.

2. If a buyer offers $49.00 per hundred with a 4% allowance for shrinkage, what will the producer receive?

   DEFINITION: The shrinkage refers to the weight loss encountered from the time the animals leave the feed lot until they are weighed over the scale at the market.

   Solution:

   $$\text{Allowance} = (\$49.00)(0.04) = \$1.96$$

   $$\text{Producer will receive} = \$47.04$$

3. Refer to the score sheet for frozen asparagus.

   (a) You count 218 pieces and find 180 heads of asparagus. What percent are heads?

   (b) This sample is rated 15 on color, 8 on uniformity and 23 on absence of defects and 28 on character. What grade is given this sample?

   Solution:

   (a) $\text{Heads} = \frac{180}{218} = 0.83 = 83\%$

   (b) B grade

B. Problems without Solutions

4. How many pounds of sugar and how many pounds of water are required to make 15,000 pounds of a 3% syrup.

5. If the average live weight of the cattle you bought was 958 pounds and their average yield in meats was 529.6 pounds, what was the dressing percentage?

6. In canned raspberries the drained weight of the solids was 0.725 grams from a 5.00 gram sample. What was the percent of solids?

7. Your shift is to pack blackberries in 30 lb tins that will be frozen. You have 31,500 lbs of blackberries to run. How many 30 lb tins of blackberries are you expected to produce? (Refer to table 10.)

B. Problems without Solutions (continued)

8. In 1973 Marion berries were 45¢ per pound for hand-picked on a no dockage basis. The trash that was allowed in a machine picked crate was 11%, and the price was 40¢ per pound.

   (a) Which method was the most profitable?

   (b) How much more per ton would the grower realize?

9. If 1,300 gallons of mix were frozen into 2,425 gallons of ice cream, what was the percentage of overrun?

10. As green beans mature the fiber of "strings" develop and causes the beans to be grade "C". Mechanically extracting the fiber results in a yield of 25 grams of fiber from a 454 gram sample. What is the percent fiber?

$$\frac{(\text{grams of fiber})(100)}{\text{grams of sample}} = \text{percent fiber}$$

11. You take a 1,000 gram sample from the truck and find that 955 grams pass through the number five sieve. This means that 955 grams of green beans are sieve size 1 through 4. What is the percent of beans that are sieve size five or larger?

B. Problems without Solutions (continued)

11. (continued)

12. The processor pays 46¢ per pound for stewing hens and 58¢ per pound for broilers. Yield of boneless meat from hens is 60% and broilers yield 75%. Which is the cheaper meat to use in making chicken soup?

13. Fresh sausage is selling for 62¢ per pound and semidry fermented sausage (thuringer, hard salami, ceveralat) is selling for $2.06 a pound. If 75% of the fresh sausage is moisture and fats lost in the process of preparing semidry sausage, which product is the most profitable to produce? State the amount per pound difference.

B. Problems without Solutions (continued)

14. DEFINITION

1. Improper draining of washed fruit or addition of water materially affects the ratio. This is a very significant factor and must be carefully checked during in-plant inspection. The significance of excess water can be readily shown by the following examples:

   (a) Assume a processor is packing strawberries to a declared ratio of 4 plus 1, that the strawberries have a soluble solids of 8.0 percent, and that for each 100 pounds of finished product, 8 pounds of water are added through improper draining.

   (b) For each 100 pounds there will be 72 pounds of berries, 8 pounds of water, and 20 pounds of dry sugar.

   (c) The theoretical solids of the finished product of a 4 plus 1 ratio should be 26.4.

   (d) The actual solids of the example illustrated may be calculated as follows:

PROBLEM

72 pounds fruit (8%) solids =
8 pounds water (no solids) =
20 pounds of sugar (100% solids) =
Finished product solids _____

B. Problems without Solutions (continued)

15. Since 40% of the load is brine and brine weighs 8.4 pounds per gallon, we compute the gallons of brine as follows: Total net capacity (truck or trailer computed separately)times 0.40 divided by 8.4 equals gallons of brine. A trailer weighs 11,000 pounds, carries a gross weight of 36,000 pounds. The net weight is 36,000 minus 11,000 = __(a)__ pounds. To compute the brine needed: $\frac{(25{,}000)(0.40)}{8.4}$ = __(b)__ gallons of brine.

16. Farmer Slinker has a flat bed truck which weighs 8,420 lbs. Slinker hauls 84 lugs of Royal Ann cherries and 42 lugs of Bing cherries. The gross weight of this load is 13,586 pounds. What should Slinker receive for this load of cherries?

    DEFINITIONS: The picking lugs average 6.85 pounds per lug. In 1973 Royal Anns were 14¢ per pound and Bings were 12¢ per pound.

17. Percents in a brine are quoted by weight. In making up the first brine, 1,200 pounds of calcium chloride is added to 15,000 gallons of fresh water. What is the percent of calcium chloride in the first brine solution? (One gallon of fresh water weighs 8.339 pounds.)

B. Problems without Solutions (continued)

18. If a 400 lb drum is declared as 4 parts fruit and 1 part 60° syrup, then 4/5 of the contents is fruit and 1/5 is packing medium. How much fruit (a), sugar (b) and water (c) are in this 400 lb drum?

DEFINITIONS: 60 degree Brix syrup means 60% sugar solids.

Level 2

19. Fancy skinned hams 24 hours in the smoke house shrink approximately 7%. If 1,152 hams averaging 10.83 lbs each were received for smoking, what would be the total weight of the smoked hams the next day?

DEFINITIONS: Fancy hams are sweet pickled. Shrinkage given represents the loss from the weight of the sweet pickle from the time it is taken out of cure until it is finished in the smoke house.

20. In 1973 raspberries were 46¢ per pound. Dockage for machine picked raspberries averaged 17.3%. Dockage for hand-picked raspberries averaged 0.2%. The grower was paying 13¢ per pound for hand-picking and 9¢ per pound for machine-picking. Assume equal damage to the raspberry canes and equal recovery of raspberries. Which picking method was the most profitable?

B. Problems without Solutions (continued)

21. A recipe for fresh pork sausage is:

15 lbs fresh ham or bacon fat
85 lbs extra lean pork trimmings
2 lbs salt
7 oz dextrose
2 oz nutmeg (ground)
1-1/2 oz Jamaica (ground) ginger
4 oz ground white pepper

The addition of dextrose is to improve the appearance. Government inspected establishments are required to state dextrose content for certain diets. What is the dextrose content in percent?

22. The steer on the hoof costs $52.00 per hundredweight and weighed 1,120 lbs and graded choice. The average dressing percentage of a choice steer is 59%. If this steer dresses out to the average percentage figure, what will cost per pound of the dressed carcass be?

DEFINITIONS: Dressing percentage may be defined as the percentage yield of chilled carcass in relation to the weight of the animal on hoof.

B. Problems without Solutions (continued)

23. Cherries are checked with a puncture meter every other day for 7 days. If there is a drop in the daily average reading of more than 30 grams between the 6th and 7th, 5% more calcium chloride is added. If this drop continues between the 9th and 10th days, another 5% calcium chloride is added.

    If 1,100 pounds of calcium chloride were added to 15,000 gallons of fresh water and the pressure drop continued through the 10th day, what was the final percentage of calcium chloride by weight? (Water weighs 8.339 lbs per gallon.)

24. In 1973, sieve size 1 through 4 green beans were $145 per ton and sieve size 5 and 6 were $70 per ton. The records on Grower Smith indicate an average yield of 1,331 tons, of which, 77.1% were sieve size 1 - 4 and 22.9% were sieve size 5 - 6. Approximately what will be the amount paid to Grower Smith in 1973?

B. Problems without Solutions (continued)

25. DEFINITION: The Food and Drug Administration has devoted considerable effort toward the development of a method for drained weight of retail size containers of fruits. Based on Food and Drug data for retail-sized packages (16 ounces and less) an estimate may be made of the amount of fruit ingredient using drained weight values. The percent of drained weight in relation to in-going weight of fruit is as follows:

Strawberries	66 percent
Red Raspberries	75 "
RSP Cherries	88 "
Peaches	80 "
Apricots	83 "
Blackberries	88 "

The put-in weight of fruit may be estimated by multiplying the drained weights by 100, and dividing by the value shown in the foregoing tabulation for the respective fruit.

PROBLEM: (a) A 12 ounce carton of frozen red raspberries having a drained weight of 8 ounces would have an estimated put-in weight of fruit of _____ ounces.

(b) A 16 ounce carton of frozen strawberries with a put-in weight of only 9 ounces should drain out to approximately _____.

B. Problems without Solutions (continued)

26. In 1973, sieve size 1 through 4 green beans were $145 per ton and sieve size 5 and 6 were $70 per ton.

Grower Gomer hasn't contracted a price or delivery date with the cannery. During the hot weather of August, in a week's time 30% of the beans will mature to sieve size 5 and 6 with an increase in weight of 23% for the entire field.

Assume that Aug 7 the 1,012 ton crop graded 1 - 4 sieve size.

(a) Would grower Gomer receive more or less on Aug 14?

(b) How much more or less?

27. You are required to keep the moisture added level below 5% in fresh sausage. If the fresh sausage is 60% moisture and 14% protein, use this formula to determine the percent added moisture:

$$\frac{(W) - (4P)}{1 - (0.01W) + (0.04P)} = \text{percent added moisture}$$

DEFINITIONS: W: percent moisture; P: percent protein

B. Problems without Solutions (continued)

28. Salt content needs to be determined for certain dietetic packs. If it takes 12.83 ml Ag NO_3 (silver nitrate) at 0.1N to precipitate the salt in a 3 gram meat product, what is the percent of salt?

Formula:

$$\frac{(\text{ml Ag } NO_3)(\text{N Ag } NO_3)(0.05845 \text{ meg wt Na Cl})(100)}{(\text{g sample})} = \text{percent Na Cl}$$

DEFINITIONS: meg = milliequivalent weight or the equivalent weight divided by 1,000. The equivalent weight of sodium is 0.023 grams and the meg is 0.023 grams or 23 milligrams.

Complete Solutions to B Problems

4. Sugar = (15,000 lbs)(0.03) = 450 lbs

Water = 15,000 lbs - 450 lbs = 14,550 lbs

5. $\text{Dressing} = \frac{529.6 \text{ lbs}}{958 \text{ lbs}} = 0.553 = 55.3\%$

6. $\text{Solids} = \frac{0.725 \text{ g}}{5.00 \text{ g}} = 0.145 = 14.5\%$

7. Loss = (31,500 lbs)(0.05) = 1,575 lbs

Blackberries packed = 31,500 lbs - 1,575 lbs
= 29,925 lbs

$\text{Tins} = \frac{29,925 \text{ lbs}}{30 \text{ lbs/tin}} = 997.5 \text{ tins}$

8. (a) Machine picked = ($0.40/lb)(2,000 lb)(1.11)
= $888 per ton

Hand picked = ($0.45/lb)(2,000 lb)
= $900 per ton

The hand picked berries are more profitable.

(b) $900 - $888 = $12

The grower will realize $12 more per ton with the hand picked berries.

9. $\text{Overrun} = \frac{2,425 \text{ gal} - 1,300 \text{ gal}}{1,300 \text{ gal}} = \frac{1,125 \text{ gal}}{1,300 \text{ gal}} = 0.8653 = 86.53\%$

10. $\text{Fiber} = \frac{(25 \text{ g})(100)}{454 \text{ g}} = 5.5\%$

11. $\text{Beans sieve size five or larger} = \frac{1,000 \text{ g} - 955 \text{ g}}{1,000 \text{ g}}$

$= \frac{45 \text{ g}}{1,000 \text{ g}} = 0.045 = 4.5\%$

Complete Solutions to B Problems (continued)

12. Hens = $\frac{\$0.46/\text{lb}}{0.60}$ = \$0.767 per pound

Broiler = $\frac{\$0.58/\text{lb}}{0.75}$ = \$0.773 per pound

Therefore, the hens are \$0.006 per pound cheaper.

13. It takes 4 lbs of the fresh sausage to have the same amount of solids as does the semidry fermented sausage.

Fresh sausage = (\$0.62/lb)(4 lbs) = \$2.48

Difference = \$2.48 - \$2.06 = \$0.42 for four lbs

Difference per pound = $\frac{\$0.42}{4}$ = \$0.105

The fresh sausage is the most profitable to produce.

14.

Fruit = (72 lbs)(0.08)	=	5.76 lbs
Water = 0.00	=	0.00 lbs
Sugar = (20 lbs)(1.00)	=	20.00 lbs
Solids in finished product		25.76 lbs

15. (a) Net weight = 36,000 lbs - 11,000 lbs = 25,000 lbs

(b) Brine = $\frac{(25{,}000 \text{ lbs})(0.40)}{8.4 \text{ lbs/gal}}$ = 1,190 gals

16. Cherries and lugs = 13,586 lbs - 8,420 lbs = 5,166 lbs

Weight of lugs = (84 lugs + 42 lugs)(6.85 lb/lug)
= (126 lugs)(6.85 lb/lug)
= 863.1 lbs

Weight of cherries = 5,166 lbs - 863.1 lbs = 4,302.9 lbs

Royal anns = $\frac{84 \text{ lugs}}{126 \text{ lugs}}$ (4,302.9 lbs)(\$0.14/lb) = \$401.60

Bing = $\frac{42 \text{ lugs}}{126 \text{ lugs}}$ (4,302.9 lbs)(\$0.12/lb) = \$172.12

Total \$573.72

Complete Solutions to B Problems (continued)

17. Water = (15,000 ~~gals~~)(8.339 lbs/~~gal~~) = 125,085 lbs

Calcium chloride = $\frac{1{,}200\ \text{~~lbs~~}}{125{,}085\ \text{~~lbs~~}}$ = 0.00959 = 0.959%

18. (a) Fruit = (400 lb)(4/5) = 320 lbs

(b) Syrup = (400 lb)(1/5) = 80 lbs
Sugar = (80 lbs)(C.60) = 48 lbs

(c) Water = 400 lbs - (320 lbs + 48 lbs)
= 400 lbs - 368 lbs
= 400 lbs - 368 lbs
= 32 lbs

Level 2

19. Weight of hams after 24 hrs = (1,152 ~~hams~~)(10.83 lbs/~~ham~~)(0.93)

= 11,602.83 lbs

20. Machine picked = ($0.46/~~lb~~)(2,000 ~~lb~~/ton)(0.827)
= $760.84/ton

Net machine picked = $760.84/ton - ($0.09/~~lb~~)(2,000 ~~lb~~/ton)
= $760.84/ton - $180/ton
= $580.84 per ton

Hand picked = ($0.46/~~lb~~)(2,000 ~~lb~~/ton)(0.998)
= $918.16/ton

Net hand picked = $918.16/ton - ($0.13/~~lb~~)(2,000 ~~lb~~/ton)
= $918.16/ton - $260/ton
= $658.16 per ton

Difference = $658.16 - $580.84 = $77.32

The hand picked berries are more profitable.

21. Total weight = (15 ~~lbs~~)(16 oz/~~lb~~) + (85 ~~lbs~~)(16 oz/~~lb~~) + (2 ~~lbs~~)(16 oz/~~lb~~)
+ 7 oz + 2 oz + 1.5 oz + 4 oz
= 240 oz + 1,360 oz + 32 oz + 14.5 oz = 1,646.5 oz

Dextrose content = $\frac{7\ \text{~~oz~~}}{1{,}646.5\ \text{~~oz~~}}$ = 0.00425 = 0.425%

Complete Solutions to B Problems (continued)

22. Cost on hoof = (11.20 ~~hundred lbs~~)($52.00/~~hundred lbs~~)
= $582.40

Dressed weight = (1,120 lbs)(0.59) = 660.8 lbs

Cost of dressed carcass = $\frac{\$582.40}{660.8 \text{ lbs}}$ = $0.88 per lb

23. Water = (15,000 ~~gals~~)(8.339 lbs/~~gal~~) = 125,085 lbs

Calcium after first add = 1,100 lbs + (1,100 lbs)(0.05)
= 1,100 lbs + 55 lbs = 1,155 lbs

Final calcium chloride = 1,155 lbs + (1,155 lbs)(0.05)
= 1,155 lbs + 57.75 lbs = 1,212.75 lbs

Calcium chloride = $\frac{1{,}212.75 \text{ ~~lbs~~}}{125{,}085 \text{ ~~lbs~~}}$ = 0.00969 = 0.969%

or just under 1%

24. Size 1 through 4 = (1,331 ~~tons~~)($145.00/~~ton~~)(0.771) = $148,799.15

Size 5 and 6 = (1,331 ~~tons~~)($70.00/~~ton~~)(0.229) = $21,335.93

Amount paid to Smith = $148,799.15 + $21,335.93 = $170,135.08

25. (a) $\frac{(8 \text{ oz})(100)}{75}$ = 10 2/3 ounces

(b) D = drained weight

$\frac{D\ (100)}{66}$ = 9 oz

D = 5.94 ounces

26. (a) Aug 7: (1,012 ~~tons~~)($145.00/~~ton~~) = $146,740.00

Aug 14: (1,012 tons)(1.23) = 1,244.76 tons

Size 5 and 6 = (1,244.76 ~~tons~~)($70.00/~~ton~~)(0.30) = $26,139.96

Size 1 through 4 = (1,244.76 ~~tons~~)($145.00/~~ton~~)(0.70) = $126,343.14

Complete Solutions to B Problems (continued)

26. (continued)

Total received Aug 14 = $26,139.96 + $126,343.14 = $152,483.10

Gomer would receive more on Aug 14

(b) Difference = $152,483.10 - $146,740.00 = $5,743.10

27. Added moisture = $$\frac{0.60 - (4)(0.14)}{[1 - (0.01)(0.60)] + (0.04)(0.14)}$$

$$= \frac{0.04}{0.994 + 0.0056} = \frac{0.04}{0.9996} = 0.04 = 4\%$$

28. Na Cl = $$\frac{(12.83 \text{ ml})(0.10)(0.05845)(100)}{39} = 2.5\%$$

SCORE SHEET FOR FROZEN ASPARAGUS

FACTORS	SCORE POINTS	
I. COLOR	20	(A)** 17-20 (B)** 14-16 (SStd)** 0-12*
II. UNIFORMITY OF LENGTH	10	(A)** 9-10 (B)** 7-8 (SStd)** 0-6x
III. ABSENCE OF DEFECTS	30	(A)** 26-30 (B)** 22-25* (SStd)** 0-21*
IV. CHARACTER	40	(A)** 33-40 (B)** 27-32* (SStd)** 0-26*
TOTAL SCORE	100	

* Limiting Rule
** Grades
x Partial Limiting Rule

A. Problems with Solutions

1. This year, 144 of our employees must retire. This number represents what percent of the total working force of 1263 employees? (nearest tenth of 1%)

   Solution:

   We must find what percent 144 is of 1263; to do this, we divide

   $$\frac{144 \text{ employees}}{1{,}263 \text{ employees}} = 0.1140 = 11.40\%$$

   The answer is only wanted to the nearest tenth of 1%, so we round to 11.4%

2. A 3 percent tax is added to the selling price of an article. Find the amount of the tax on an article that sells for $18.60.

   Solution:

   A sales tax is computed by multiplying the price of an article by the tax amount in percent.

   ($18.60)(0.03) = $0.0558 = $0.56

3. The Zee Company allows a 2 1/2% cash discount if bills are paid within 10 days. If a customer pays a bill of $965 within 10 days, how much discount can he deduct from this amount?

   Solution:

   A discount is a reduction in the cash price. To find the amount of discount, we multiply the cash price by the rate of discount

   ($965)(0.025) = $24.125

4. Property worth $35,000 is assessed at a rate of 19.3%. What are the taxes if the rate is 65 mills on the dollar?

   Solution:

   There are 1000 mills per dollar. If property is assessed at 19.3%, this would mean you pay 65 mills on
   ($35,000)(0.193) = $6,755

   65 mills = 0.065
   Taxes = ($6,755)(0.065) = $439.08

A. Problems with Solutions (continued)

5. A bill of goods totals $200.20, less discounts of 25%, 10% and 33 1/3%. Find the single equivalent discount and the net cost?

Solution: This problem can be solved two ways:

(1) ($200.20)(0.25) = $50.05
$200.20 - $50.05 = $150.15
($150.15)(0.10) = $15.015
$150.15 - $15.015 = $135.135
($135.135)(0.3333333) = $45.045
$135.135 - $45.045 = $90.09 net cost

Total discount = $50.05 + $15.015 + $45.045 = $110.11
Single equivalent discount = $\frac{\$110.11}{\$200.20} = 0.55 = 55\%$

(2) Total percent discount = 1 - (0.75)(0.90)(0.6666)
1 - 0.45 = 0.55 = 55%
Net cost = $200.20 - ($200.20)(0.55)
= $200.20 - $110.11 = $90.09

B. Problems without Solutions

6. Mrs. Haynes' salary was increased from $160 to $172 a week. What was the percent of increase?

Solution:

7. Divide $30,186 between 3 organizations; giving 1 organization 60% and the other 2 equal amounts.

Solution:

B. Problems without Solutions (continued)

8. Mr. Swartz received a commission of 2 1/2% on all sales made above $300 in any single day. If his sales for Monday through Saturday amounted to $350, $475, $500, $310, $671, and $392, respectively, how much did he earn in commissions for the week?

   Solution:

9. A radio may be purchased for $75.00 cash or 10% down and 12 monthly payments of $6.50. Find: (a) the total cost on the installment plan, (b) the interest rate.

   Solution:

10. The Haight School District ordered 220 books from the Ever Ready Publishing Company on December 15, with a request for a March 1, billing. The books sold for $3.75 each less a 20% trade discount. Shipping charges amounted to $4.50. A cash discount of 1% was allowed for payment within 5 days of the billing date. If the invoice was paid on March 2, what was the amount of the payment? (NOTE: The cash discount cannot be applied to shipping charges.)

    Solution:

B. Problems without Solutions (continued)

11. A share of common stock worth $33 earns $1.20 annually. The return equals what percent of the investment (nearest tenth of 1%)?

    Solution:

12. Jim Jones sells on a 25% commission basis. Last month he earned $900. What was the total amount of his sales for last month?

    Solution:

13. An agent receives a 15 percent commission for selling, makes a cash sale of $456. How much should he send in to his company if he first deducts his commission?

    Solution:

14. If the salary of an employee is cut 20 percent, what percent raise on this reduced salary would he need to bring the salary back to its former level?

    Solution:

B. Problems without Solutions (continued)

15. Find the yearly depreciation on a typewriter originally costing $125 by the straight-line method if the life of the machine is assumed to be 10 years.

Solution:

16. A company employing 250 office workers had to replace 26 of them during a certain year owing to inefficiency. The next year the number replaced for the same reason was reduced 100% from the previous year. How many employees were dismissed for inefficiency during the second year?

Solution:

17. The value of a frame house at the end of six years was estimated to be $7,650. What was the original cost of the house if the yearly rate of depreciation was 2 1/2 percent?

Solution:

B. Problems without Solutions (continued)

18. A manufacturer sells an article so as to make 50 percent of the cost. The middleman sells it so as to make 25 percent of his selling price, and the retailer sells it so as to make 20 percent of his selling price. If the retailer's selling price was $12, what was the manufacturer's cost?

Solution:

19. How much will it cost the buyer if the manufacturer of an item sells it for $516.10 less 12 1/2%, 6 1/4%, and 2%?

Solution:

20. A manufacturer writes off at the end of each of 5 years, 20 percent of the value of a machine at the beginning of that year. What percent of the original value does he still place on the machine at the end of the fifth year?

Solution:

Complete Solution to B Problems

6. First subtract to find the amount of increase
$\$172 - \$160 = \$12$
The percent of increase would be:
$\frac{\$12}{\$160} = 0.075 = 7.5\%$

7. First we find 60% of $30,186
$(\$30,186)(0.60) = \$18,111.60$ amount for one organization
$\$30,186.00 - \$18,111.60 = \$12,074.40$ left
Amount for other two organizations $= \frac{\$12,074.40}{2} = \$6,037.20$

8. His sales over $300 were:
$\$350 - \$300 = \$\ 50$
$\$475 - \$300 = \ 175$
$\$500 - \$300 = \ 200$
$\$310 - \$300 = \ 10$
$\$671 - \$300 = \ 371$
$\$392 - \$300 = \ 92$
$\$898$ total sales over $300
Commission $= (\$898)(0.025) = \$22.45$

9. (a) Total cost = down payments + monthly payments
$= (\$75.00)(0.10) + (12)(\$6.50)$
$= \$7.50 + \$78.00 = \$85.50$

(b) Interest = amount paid - cost of radio
$= \$85.50 - \$75.00$
$= \$10.50$

Interest rate: $= \frac{\text{interest}}{\text{price}} = \frac{\$10.50}{\$75.00} = 0.14 = 14\%$

10. Price of books = (220 books)($3.75/book) = $825.00
Trade discount = ($825.00)(0.20) = $165.00
Cash discount = ($825 - $165)(0.01) = ($660)(0.01) = $6.60
Amount of payment = ($660 - $6.60) + $4.50 = $657.90

11. We must find what percent $1.20 is of $33; to do this, we divide
$\frac{\$1.20}{\$33} = 0.0363 = 3.63\%$ rounded off to 3.6%

12. We must find the base when $900 is 25% of that amount; to do this we divide $\frac{\$900}{0.25} = \$3,600$

13. We must first find the commission:
$(\$456)(0.15) = \$68.40$
Amount to be sent to company = $456.00 - $68.40 = $387.60

Complete Solutions to B Problems (continued)

14. First we find that the salary would be
100% - 20% = 80%
To reach the 100% we must have an increase of 20% of the former level, therefore, we must find what percent 20 is of 80; to do this, we divide
$$\frac{20}{80} = 0.25 = 25\%$$

15. To find straight-line depreciation, we take the cost and divide by the number of years.
$$\frac{\$125}{10 \text{ years}} = \$12.50 \text{ per year}$$

16. To find the reduction of people to be replaced, we take 100% of 26
(1.00)(26) = 26 Therefore, 26 -26 = 0 None to be replaced.

17. Total amount depreciated = (number of years)(annual rate)
= (6 years)(0.025/yr) = 0.15
Amount non-depreciated = 1.00 - 0.15 = 0.85
We must find the base when 85% of the base is $7,650.
$$\text{Base} = \frac{\$7,650}{0.85} = \$9,000$$

18. Retailer's profit = (0.20) ($12) = $2.40
Retailer's cost
Middleman's selling price } = $12.00 - $2.40 = $9.60
Middleman's profit = ($9.60)(0.25) = $2.40
Middleman's cost
Manufacturer's selling price } = $9.60 - $2.40 = $7.20
Manufacturer's cost + (0.50)cost = $7.20
$$\text{Manufacturer's cost} = \frac{\$7.20}{1.50} = \$4.80$$

19. $516.10 - ($516.10)(0.125) = $516.10 - $64.51 = $451.59
$451.59 - ($451.59)(0.0625) = $451.59 - $28.22 = $423.37
$423.37 - ($423.37)(0.02) = $423.37 - $8.47 = $414.90

20. Using discount method:
100% - 20% = 80%
(0.80)(0.80)(0.80)(0.80)(0.80) = 0.32768 = 32.768%
Original value left on machine is 32.768%

A. Problems with Solutions

1. Analyze the feasibility of logging a 10 million board foot stand of timber using the Washington 208F Yarder and Tower. The operating costs for the yarder including maintenance, depreciation, and labor for the six-man crew have been calculated in other problems and are listed below along with cutting, loading, and other costs which make up the total. A 20% Profit and Risk Factor is to be used.

   a) Determine the cost per MBF on a bisis of 40, 50, and 60 MBF of logs per day.
   b) Assume that the price of stumpage is $140 per MBF and that the price received for the logs delivered at the mill is $187. Is the operation feasible if the output is 40 MBF per day? 50 MBF per day? 60 MBF per day?

Logging Costs

Owning & Operating	$108.86 per hour
Cutting	6.00 per MBF
Loading	4.50 per MBF
Hauling	8.00 per MBF
Transportation (3 vehicles owning and operating cost at $0.20 per mile average of 75 miles per day each)	45.00 per day
Miscellaneous (Supplies, Office, Bookkeeping, Communications and Fire Equipment)	125.00 per day

All roads are in. No road maintenance required.

Solution:

a) Logging Cost per MBF

40 MBF per day

Cutting ($6.00/MBF)(40 MBF/day)	$ 240.00
Hauling ($8.00/MBF)(40 MBF/day)	320.00
Loading ($4.50/MBF)(40 MBF/day)	180.00
Transportation	45.00
Miscellaneous	125.00
Yarding ($108.86/hr)(8 hrs/day)	870.88
Subtotal	$1,780.88
Plus 20% Profit and Risk	356.18
Cost per day	$2,137.06

$$\text{Cost per MBF} = \frac{\text{Cost per day}}{\text{MBF per day}} \qquad \$53.42$$

A. Problems with Solutions (continued)

1. Solution (continued)

50 MBF per day

Cutting	($6.00/MBF)(50 MBF/day)	$ 300.00
Hauling	($8.00/MBF)(50 MBF/day)	400.00
Loading	($4.50/MBF)(50 MBF/day)	225.00
Transportation		45.00
Miscellaneous		125.00
Yarding	($108.86/hr)(8 hrs/day)	870.88
	Subtotal	$1,965.88
20% Profit and Risk		393.18
	Cost per day	$2,359.06

$$\text{Cost per MBF} = \frac{\text{Cost per day}}{\text{MBF per day}} \qquad \$47.18$$

60 MBF per day

Cutting	($6.00/MBF)(60 MBF/day)	$ 360.00
Hauling	($8.00)(60 MBF/day)	480.00
Loading	($4.50/MBF)(60 MBF/day)	270.00
Transportation		45.00
Miscellaneous		125.00
Yarding	($108.86/hr)(8 hrs/day)	870.88
	Subtotal	$2,150.88
20% Profit and Risk		430.18
	Cost per day	$2,581.06

$$\text{Cost per MBF} = \frac{\text{Cost per day}}{\text{MBF per day}} \qquad \$43.02$$

b) Feasibility

The operation is profitable only if the selling price of the logs equals or exceeds the sum of the stumpage plus the total logging costs including the profit and risk factors. Operation is feasible at 50 MBF per day or more.

A. Problems with Solutions (continued)

2. Determine the cost per hour for operating a D7F Caterpillar excluding the wages of the operator based on the following information?

Initial Price:	$74,000
Depreciation:	Straight line, based on a turn-in value of 20% of the new price after 10,000 hours.
Insurance:	3% of purchase price, based on 10,000 hours of useful life.
Personal Property Tax:	2% of purchase price based on 10,000 hours.
Interest:	11.5% of the difference between the purchase price and a 20% down payment based on 10,000 hours.
Fuel:	$1.12 per hour.

Lubricants and other supplies (per hour of operation):

Engine Oil	$0.04
Transmission	$0.03
Final Drive	$0.02
Hydraulics	$0.03
Grease	$0.01
Filters	$0.08

Maintenance: $7.00 per hour.

Solution:

Depreciation

$$\text{Cost per hour} = \frac{(\text{Purchase Price})(0.8)}{10{,}000 \text{ hours}}$$

$$= \frac{(\$74{,}000)(0.8)}{10{,}000 \text{ hours}} = \$5.92/\text{hr}$$

Insurance

$$\text{Cost per hour} = \frac{(\$74{,}000)(0.03)}{10{,}000 \text{ hours}} = \$0.222/\text{hr}$$

A. Problems with Solutions (continued)

2. Solution: (continued)

Taxes

$$\text{Cost per hour} = \frac{(\$74{,}000)(0.02)}{10{,}000 \text{ hours}} = \$0.148/\text{hr}$$

Interest

$$\text{Cost per hour} = \frac{(\$74{,}000)(0.8)(0.115)}{10{,}000 \text{ hours}} = \$0.681/\text{hr}$$

Lube & Supplies

Cost per hour	Oil	$0.04
	Trans	0.03
	Final	0.02
	Hyd	0.03
	Grease	0.01
	Filters	0.08
Total		$0.21/hr

Maintenance

Cost per hour = $7.00/hr

Fuel

Cost per hour = $1.12/hr

Total cost of operation per hour = $5.92/hr + $0.222/hr + $0.148/hr + $0.681/hr + $0.21/hr + $7.00/hr + $1.12/hr
= $15.30/hr

B. Problems without Solutions

3. The earth's surface is 71% water and 29% land. 7.5% of the earth's surface is forest land. What percent of the land area is forest land?

B. Problems without Solutions (continued)

4. A line was measured with a 100 ft chain and found to be 813.67 feet long. Later the chain was found to be 99.91 ft long. What was the corrected length of the line? Round your answer to the nearest 0.01 ft.

5. Oregon produced 95 million seedlings during the 4 years 1968 to 1972. If 24% of these were planted during 1970-72 at a density of 454 seedlings per acre, how many acres were planted during the years 1970-72?

6. Air quality standards set the level of eye irritation at 0.10 parts of pollutants per million parts of air. Using the formula:

$$\text{Percent} = \frac{\text{number of pollutants}}{\text{number of parts}}$$

What percent does 0.10 parts per million represent?

7. The growth in volume of trees can be expressed as a percent of the volume originally measured. The result of a timber cruise in 1967 indicated 4,700 MBF. If the growth rate is approximately 5% per year, a) what would be the increase in MBF during the next year, b) during the second year after the cruise? (Work on the basis of a simple interest problem.)

B. Problems without Solutions (continued)

8. In a 5,000 tree sample it is found that 29% are under 5 feet tall. 21% of those under 5 ft are under 3 ft tall.

   a) What percent of the total sample is under 3 feet?

   b) What percent of the total sample is equal to or over 5 feet?

9. 788,000 acres or 3% of the forest lands in Oregon are state owned. 10.3 million acres are privately owned. The balance is owned by the federal government. Determine a) the number of acres of forest lands in Oregon owned by the federal government and b) the percent of all forest lands in Oregon which are privately owned.

B. Problems without Solutions (continued)

10. In a controlled forest area there were 645 snags and 75 woodpeckers. Fifteen of the woodpeckers were successful in boring completely through one snag each.

    a) What percent of the woodpeckers were successful in this respect?
    b) What percent were unsuccessful?
    c) Check the total of a) and b).
    d) What percent of the snags were bored through?
    e) What percent of the snags were not bored through?

11. A company employs a total of 15 people. Six of them earn $8,500 per year, two earn $10,500, two were employed at an annual salary of $11,000 but received a 9% raise mid-way through the year. The remaining employees earn $9,800. Determine the average annual salary for the employees.

B. Problems without Solutions (continued)

12. Determine the owning cost on an hourly basis for a Washington 208F Yarder and Tower including Hydraulic Choker Carriage and lines given the following data:

Delivered price	$ 305,000
Less line replacement cost	20,000
Less estimated residual value	85,000

Use straight line depreciation with a working season of 1,500 hours per year and a useful life of 6 years. Interest on the balance owed, insurance and taxes are 10%, 1.5% and 2.5%, respectively. The cost of these last three items is equivalent to $0.05 per $1,000 delivered price.

13. Complete the following portion of a timber sale contract.

Species	Class of Material	Unit	Price per Unit	No. of Units	Value	5% Sales Tax	Total
PP	Sawlogs	M bd ft	$110	350.41	_____	_____	_____
SP	Sawlogs	M bd ft	$125	108.40	_____	_____	_____
DF	Peeler logs	M bd ft	$138	185.00	_____	_____	_____
Oak	Fuelwood	Cord	$10	78.00	_____	_____	_____
			Totals		_____	_____	_____
		Cross Check Total					_____

B. Problems without Solutions (continued)

14. When the lumber yield from a mill exceeds that predicted from the log scale, the excess is called overrun. When the log scale is larger than the sawed out-put, an underrun occurs. In general

$$\text{Percent overrun (or underrun)} = \frac{\text{mill tally - log scale}}{\text{log scale}} (100)$$

Calculate the percent overrun or underrun from the data below for both the Doyle and International Scale.

d.i.b.	length	Doyle Scale	Int. Scale	Lumber Tally
13	10	50	70	83
16	12	108	130	127
11	16	49	80	70
18	12	147	170	174
13	12	61	85	82
Total bd ft		_____	_____	_____
Overrun, percent		_____	_____	

3. 7.5 parts of 29 parts is forest land.

$$\text{Percent forest} = \frac{7.5}{29}(100) = 25.86\%$$

4. $$\text{Number of chain lengths} = \frac{813.67 \text{ ft}}{100 \text{ ft/chain}} = 8.1367 \text{ chains}$$

$$\begin{aligned}\text{Corrected length} &= (8.1367 \text{ chains})(\text{actual length}) \\ &= (8.1367 \text{ chains})(99.91 \text{ ft/chain}) \\ &= 812.94 \text{ ft}\end{aligned}$$

5. $$\text{Number of acres} = \frac{\text{number of seedlings}}{\text{seedlings per acre}}$$

$$\begin{aligned}\text{Number of seedlings} &= (95{,}000{,}000 \text{ seedlings})(0.24) \\ &= 22{,}800{,}000 \text{ seedlings}\end{aligned}$$

$$\text{Acres} = \frac{22{,}800{,}000 \text{ seedlings}}{454 \text{ seedlings/acre}} = 50{,}220 \text{ acres}$$

6. $$\text{Percent} = \left(\frac{\text{number of parts pollutants}}{\text{number of parts air}}\right)(100)$$

$$= \left(\frac{0.1 \text{ parts}}{1{,}000{,}000 \text{ parts}}\right)(100) = 0.00001\%$$

7. $100\% - 29\%$

(a) $$\text{Increase} = (0.05)(4{,}700 \text{ MBF}) = 235 \text{ MBF}$$

(b) $$\text{Increase} = (0.05)(235 \text{ MBF} + 4{,}700 \text{ MBF}) = 246.75 \text{ MBF}$$

8. $$\text{Percent under 5 ft tall} = (5{,}000 \text{ trees})(0.29) = 1{,}450 \text{ trees}$$

$$\text{Percent under 3 ft tall} = (1{,}450 \text{ trees})(0.21) = 304 \text{ trees}$$

(a) $$\text{Percent sample under 3 ft tall} = \left(\frac{304 \text{ trees}}{5{,}000 \text{ trees}}\right)(100) = 6.1\%$$

(b) $$\begin{aligned}\text{Percent of sample equal to or over 5 ft tall} &= 100\% - 29\% \\ &= 71\%\end{aligned}$$

9. Let T represent the total acres of Oregon forest land, then

$$(3/100)T = 788{,}000 \text{ acres}$$

$$T = \frac{78{,}800{,}000 \text{ acres}}{3} = 26{,}266{,}667 \text{ acres}$$

Complete Solutions to B Problems (continued)

9. (continued)

Federally owned = 26,266,667 acres - (10,300,000 acres + 788,000 acres)
= 15,178,667 acres

$$\text{Percent privately owned} = \left(\frac{10{,}300{,}000 \text{ acres}}{26{,}266{,}667 \text{ acres}}\right)(100) = 39.2\%$$

10. (A) $$\text{Percent successful woodpeckers} = \left(\frac{\text{number successful}}{\text{total}}\right)(100)$$

$$= \left(\frac{15 \text{ woodpeckers}}{75 \text{ woodpeckers}}\right)(100) = 20\%$$

(B) $$\text{Percent unsuccessful} = \left(\frac{\text{number unsuccessful}}{\text{total}}\right)(100)$$

$$= \left(\frac{75 \text{ woodpeckers} - 15 \text{ woodpeckers}}{75 \text{ woodpeckers}}\right)(100)$$

$$= 80\%$$

(C) Check total = 20% + 80% = 100%

(D) $$\text{Percent bored snags} = \left(\frac{\text{number snags bored}}{\text{total number of snags}}\right)(100)$$

$$= \frac{15 \text{ snags}}{645 \text{ snags}}\ (100) = 2.3\%$$

(E) Snags not bored = 100% - 2.3% = 97.7%

11. $$\text{Average salary} = \frac{\text{Total salary}}{\text{Employees}}$$

$$\text{Total salary} = (6)(\$8{,}500) + (2)(\$10{,}500) + (5)(\$9{,}800) + (2)\left(\frac{\$11{,}000}{2} + \frac{\$11{,}000 + (\$11{,}000)(0.09)}{2}\right)$$

$$= \$51{,}000 + \$21{,}000 + \$49{,}000 + \$22{,}990$$
$$= \$143{,}990$$

$$\text{Average salary} = \frac{\$143{,}990}{15 \text{ people}} = \$9{,}599.33/\text{ person}$$

Complete Solutions to B Problems (continued)

12. Depreciation base = delivered price - (line replacement cost + residual value)
= $305,000 - ($20,000 + $85,000)
= $200,000

$$\text{Depreciation} = \frac{\$200{,}000}{(1{,}500 \text{ hr/yr})(6 \text{ yr})} = \$22.22 \text{ per hour}$$

$$\text{Interest, insurance \& taxes} = \left(\frac{\$0.05}{\$1{,}000}\right)\$305{,}000$$

$$= \$15.25 \text{ per hr}$$

Total cost = Depreciation + Interest, insurance & taxes
= $22.22 + $15.25
= $37.47 per hour

13. PP:
Value = ($110/MBF)(350.41 MBF) = $38,545.10
Tax = ($38,545.10)(0.05) = $1,927.26
Total = $38,544.10 + $1,927.26 = $40,472.36

SP:
Value = ($125/MBF)(108.40 MBF) = $13,550.00
Tax = ($13,550.00)(0.05) = $677.50
Total = $13,550.00 + $677.50 = $14,227.50

DF:
Value = ($138/MBF)(185.00 MBF) = $25,530.00
Tax = ($25,530.00)(0.05) = $1,276.50
Total = $25,530.00 + $1,276.50 = $26,806.50

OAK:
Value = ($10/cord)(78.00 cords) = $780.00
Tax = ($780.00)(0.05) = $39.00
Total = $780.00 + $39.00 = $819.00

TOTALS
Value = $78,405.10 Tax = $3,920.26
Grand Total = $82,325.36

14. $$\text{Percent overrun (underrun)} = \left(\frac{\text{mill tally - log scale}}{\text{log scale}}\right)(100)$$

Doyle scale total = 50 + 108 + 49 + 147 + 61 = 415
International scale total = 70 + 130 + 80 + 170 + 85 = 535

Complete Solutions to B Problems (continued)

14. (continued)

Lumber tally total = 83 + 127 + 70 + 174 + 82 = 536

OVERRUN (UNDERRUN)

$$\text{Doyle scale} = \left(\frac{536 - 415}{415}\right)(100) = 29.2\% \text{ overrun}$$

$$\text{International scale} = \left(\frac{536 - 535}{535}\right)(100) = 0.19\% \text{ overrun}$$

A. Problems with solutions.

1. The total direct costs for a sale in the Deschutes National Forest is $140,744.

a) The total cost to the ranger district is the total direct cost, plus administrative costs which amount to 15% of the total final cost to the ranger district. Determine the total cost to the ranger district.

b) The total cost to the regional office is the total cost to the ranger district (part b) plus administrative costs of 21% of the total cost to the regional office. Determine the administrative costs and total cost to the regional office.

Solution:

a) Since 15% of the final cost is to be added, $140,744 represents 100 - 15 = 85% of the final cost (B).

$$0.85\ B = \$140744$$

$$B = \frac{\$140744}{0.85} = \$165,581$$

b) Since 21% of the final cost is to be added, $165,581 represents 100 - 21 = 79% of the final cost (B).

$$0.79\ B = \$165,581$$

$$B = \frac{\$165,581}{0.79} = \$209,596.$$

Administrative costs are $209596 - $165581 = $44,015.

A. Problems with solutions, continued.

2. In an area to be reforested, 1000 acres is to be aerially reseeded with Douglas Fir.

a) It is required that 800 seedlings/acre survive, however only 2% of the seedlings live through the first growing season in this area. How many seeds/acre should be planted to adapt to these conditions?
b) Since the seed which is purchased, lab tests to 73% pure live seed, how many seeds/acre should be planted?

c) If there are 35000 seeds/lb, how many pounds of seed are necessary to seed the entire 1000 acres?

d) At $22.50/lb what will the total cost be for the Douglas Fir seed?

Solution:

a) Since only 2% survive $(0.02)(B) = 800$

$$B = \frac{800 \frac{\text{seedlings}}{\text{acre}}}{0.02} = 40{,}000 \text{ seeds/acre should be planted}$$

b) Since only 73% of the seed is good $0.73B = 40{,}000$

$$B = \frac{40000 \frac{\text{seeds}}{\text{acre}}}{0.73} = 54{,}795 \text{ seeds/acre should be planted.}$$

c) $$\left(\frac{54{,}795 \text{ seeds}}{\text{acre}}\right)\left(\frac{1 \text{ lb}}{35000 \text{ seeds}}\right)(1000 \text{ acres}) = 1566 \text{ lbs}$$

d) ($22.50/lb)(1566 lbs) = $35,235

A. Problems with solutions, continued.

3. a) The direct costs from a timber sale is $36,204. To determine the final cost for site restoration, a ranger district's overhead cost of 22% of the final cost is added to the direct costs. Determine the final cost for site restoration to the district for this sale.

b) (Refer to Part (a)) If the regional foresters office assesses another 21% of their final cost to the region for regional overhead, what would be the final cost to the region for the timber sale in part (a)? What is the actual regional overhead cost?

Solution :

a) Since 22% of the final cost (B) is to be added to the direct costs ($36,204) to get the final cost, we have the equation:

$0.22B + \$36,204 = B$

or, $\$36,204 = 0.78\ (B)$

or, $\frac{\$36,204}{0.78} = B,$

so, $B = \$46,415.$

b) Following a similar procedure we have:

$0.21B + \$46,415 = B$

or, $\$46,415 = 0.78(B)$

or $\frac{\$46,415}{0.78} = B$

so, $B = \$58,753$

The actual regional overhead cost is:

$\$58,753 - \$46,415 = \$12,338$

B. Problems without solutions, continued.

4. A timber company paid $522,000 for 1.06 million board feet of timber in the Deschutes National Forest. The timber had been appraised at $384,000.

a) How much did the company pay above the appraised value? What per cent of the appraised value was this?

b) Costs for slash disposal, replanting, road construction and maintenance amounted to 87% of the appraised price. What is the amount of these costs?

c) After the costs in part (b) are deducted from the sale price the remaining amount is called the net receipts for the sale. What are the net receipts for this sale? What % of the sale price is the net receipts?

d) Deschutes, Jefferson, Klamath and Lake counties share 25% of the net receipts from timber sales in the Deschutes National Forest to be used for roads and schools. How much will the counties share from this sale?

B. Problems without solutions, continued.

5. The net merchandizable volume of a tree is determined by deducting the defective (cull)- volume from the gross volume. Determine the merchantable volume of the following trees to the nearest bd.ft.

Tree ht in logs \ No. of logs	1	2	3	4	5	6	7	8	9	10
	Percentage distribution									
1	100	of gross volume (16ft log								
2	85	15								
3	55	35	10							
4	41	31	20	8						
5	32	27	21	14	6					
6	27	23	19	15	11	5				
7	23	20	17	15	12	8	5			
8	20	18	16	14	12	9	7	4		
9	17	16	15	13	11	10	8	6	4	
10	16	15	13	12	11	10	8	7	5	3

a) A two log tree of gross volume 160 bd ft. where the second log is 50% cull.

b) A three log tree of gross volume 460 bd. ft. if the first log is 30% cull and the third log 100% cull.

c) A five log tree of gross volume 3170 bd. ft. whose first three logs are each 10% cull and whose last two logs are each 50% cull.

B. Problems without solutions, continued.

6. In quality control one of the concerns is the change in weight after the product has been soaked in water for a 24 hour period. Determine the per cent increase in weight given the following data:

a) original wt = 159.5g ; final wt = 188.9 g

b) original wt = 390.4g ; final wt = 408,9 g

c) original wt = 238.6g ; final wt = 258.5 g

B. Problems without solutions, continued.

7. In the production of particleboard one of the concerns is the change in thickness after the product has been soaked in water for a 24 hour period. Determine the per cent increase in thickness given the following data:

a) original thickness = .503 in, final thickness = .519 in.

b) original thickness = .376 in, final thickness = .407 in.

c) original thickness = .757 in, final thickness = .767 in.

B. Problems without solutions, continued.

B. Using the accompanying table solve the following:

a) The total volume of a 4 log tree is 1500 bd. ft. Determine the actual volume of each log.

b) In an 8 log tree of total volume 4640 bd. ft. what is the total volume of the last three logs?

c) The first log in a 7 log tree has a volume of 400 bd. ft. What is the volume of the tree?

Tree ht in (logs) \ No. of logs	1	2	3	4	5	6	7	8	9	10
	100	Percentage distribution								
1	100	of volume (16 ft. logs)								
2	85	15								
3	55	35	10							
4	41	31	20	8						
5	32	27	21	14	6					
6	27	23	19	15	11	5				
7	23	20	17	15	12	8	5			
8	20	18	16	14	12	9	7	4		
9	17	16	15	13	11	10	8	6	4	
10	16	15	13	12	11	10	8	7	5	3

Complete solutions to B problems.

4. Solution:

a) $522,000 - $384,000 = $138,000 $\qquad \frac{\$138,000}{\$384,000} = 0.359 = 35.9\%$

b) .87 ($384,000) = $334,080

c) $522,000 - $334,080 = $187,920

$\frac{\$187920}{\$522000}$ = 0.36 = 36% of sale price

d) (0.25) ($187,920) = $46,980

5. Solution:

a) Since the second log is 15% of the total volume it contains (0.15) (160) = 24 bd. ft. Since this log is 50% cull it has a total defect of (0.50) (24 bd. ft)=12 bd. ft. Thus the merchantable volume is 160 bd. ft. - 12 bd. ft = 148 bd. ft.

b) Since the first log is 55% of the total volume it contains (0.55) (460) = 253 bd. ft of which 30% or (0.30) (253) = 76 bd. ft is cull. The third log is 10% of the total or (0.10)(460) = 46 bd. ft. which is 100% cull. Thus the merchantable volume is 460-76- 46 = 338 bd. ft.

c) Since the first three logs contain 32% + 27% + 21% = 80% or (0.80)(3170) = 2536 bd. ft. and 10% of this is cull, we have (0.10)(2536) = 254 bd. ft. defective. The last two logs total 14% + 6% or (0.20) (3170) = 634 bd. ft of which 50% or (0.50) (634)= 317 is cull. The merchantable volume is then 3170 - 254 - 634 = 2282 bd. ft.

Complete solutions to B problems, continued.

6. Solution:

In each case we use the formula p =rb where p= increase in cut, r = per cent increase, and b = the original cut.

a) increase = 188.9y - 159.5q = 29.4q

(r)(159.5q) = 29.4q

$$r = \frac{29.4q}{159.5q} = 0.184q = 18.4\% \text{ increase}$$

b) increase = 408.9q - 390.4q = 18.5q

(r) (390.4q) = 18.5

$$r = \frac{18.5q}{390.4q} = 0.047 = 4.7\% \text{ increase}$$

c) increase = 258.5q - 238.6q = 19.9q

(r)(238.6q) = 19.9q

$$r = \frac{19.9q}{238.6q} = 0.083 = 8.3\% \text{ increase}$$

Complete solutions to B problems, continued.

7. Solution:

In each case we use the formula p = rb where p = increase in thickness, r = per cent increase and b = original thickness.

a) increase = 0.519in - 0.503 in = 0.016 in

0.016 in = (r) (0.503 in)

$$r = \frac{0.016 \text{ in}}{0.503 \text{ in}} = 0.032 = 3.2\% \text{ increase}$$

b) increase = 0.407in - 0.376in = 0.031 in

0.031 in = r (0.376 in)

$$r = \frac{0.031 \text{ in}}{0.376 \text{ in}} = 0.082 = 8.2\% \text{ increase}$$

c) increase = 0.767 in - 0.757 in = .010 in

0.010 in = r (.757 in)

$$r = \frac{0.010 \text{ in}}{0.757 \text{ in}} = 0.0132 = 1.32\% \text{ increase}$$

8. Solutions:

a) Since log 1 is 41% of the total (0.41) (1500bd ft) = 615 bd. ft.
Since log 2 is 31% of the total (0.31) (1500bd ft) = 465 bd. ft.
Since log 3 is 20% of the total (0.20) (1500bd ft) = 300 bd. ft.
Since log 4 is 8% of the total (0.08) (1500bd ft) = 120 bd.ft.

b) Since logs 6,7,8 comprise 9% + 7% +4% = 20% of the tree
(0.20) (4640bd ft) = 928 bd. ft.

c) Since the first log is 23% of the total volume we have
(0.23) (Total volume) = 400 bd ft. so , total volume =

$$\frac{400 \text{ bd ft.}}{0.23} = 1739 \text{ bd.ft.}$$

A. Problems with Solutions

1. The nozzle pressure from a 125 foot lay of hose is 135 lbs while the pump pressure is 174 lbs. What is the total percentage loss in the fire hose?

   Solution:

   You need to find the number of pounds of pressure loss, and then find what percent of the pump pressure would give us the pressure loss.

   174 lb - 135 lb = 39 lb pressure loss

   What percent of 174 is 39?

   $\% = \frac{39}{174}$

   $= 0.2241 = 22.41\%$ So the total percentage loss is 22.41%

2. In 1965, a survey of 1352 cities conducted by the International City Managers Association revealed that 1135 police departments were operating some type of inservice training program for their officers. What percentage were offering inservice training programs?

   Solution:

   What percent of 1352 is 1135?

   $\% = \frac{1135}{1352}$

   $.839 = 83.9\%$ So 83.9% of the cities considered in the program have inservice training programs.

3. A certain house burns 10 tons of coal in a heating season. The heat of combustion of the coal is 11,000 BTU/lb. If stack losses are 15%, how many BTU were actually used to heat the house?

   Solution:

   You need to determine how many BTUs there are in the combustion of 10 tons of coal, and then take 15% of the total BTUs and subtract that answer from the total BTUs.

   10 tons = 20,000 lbs.
   (20,000 lbs)(11,000 BTU/lb) = 220,000,000 BTU
   15% of 220,000,000 = (0.15)(220,000,000 BTU) = 33,000,000 BTU
   220,000,000 - 33,000,000 = 187,000,000 BTU
   Therefore, the actual number of BTUs used in heating the house is 187,000,000 BTU.

B. Problems without Solutions

4. An insurance company paid $32,500 for fire damage to a building. This was 20% less than the actual loss. What was the actual loss?

5. In Fire Crew 72, 28% of the men received injuries requiring first aid. If there are 36 men in the crew, how many had injuries?

6. In 1969, 5,148 burglaries were committed using a window as the point of entry. Of these, 51.2% were committed using the rear window. How many burglaries would this be?

7. The fire departments of New York City responded to 85,983 calls during the year 1971. What was the average number of calls per day? What was the average number of calls per hour? (365 days = one year.)

B. Problems without Solutions (continued)

8. Suppose that the amount of money spent for supplies in 1973 for a division in a City Department was $15,650. This represented an increase of 12% over the amount spent for supplies for this division in 1972. What was the amount of money spent for supplies for this division in 1972?

9. Two pumpers are set in series on a long hose line. The first increases the hydrant pressure 92% and the second increases the pressure of the first by 88%. If the hydrant pressure is 54 lbs/in^2, what is the pressure at the outlet of the second pump?

10. Five police officers are taking target practice. The number of rounds fired by each and the percentage of perfect shots in as follows:

Officer	R	80 rounds fired:	30% perfect shots
	S	70 rounds fired:	40% perfect shots
	T	75 rounds fired:	60% perfect shots
	U	92 rounds fired:	25% perfect shots
	V	96 rounds fired:	66 2/3% perfect shots

Find the percentage of perfect shots fired by all the officers.

B. Problems without Solutions (continued)

11. Two percent of all school children are problem children. Some 80% of these problem children become delinquents, and about 80% of the delinquent children become criminals. According to this analysis, if the school population is 1,000,000 children, what number of this group will eventually become criminals?

12. Of the 22,480 burglaries committed in Washington, D.C. in 1969, 6.8% were committed in February and 10.1% were committed in December. How many more burglaries took place in December than in February?

13. A hose line is made up of 12 fifty-foot sections. The pressure reading at the pumper is 144 pounds. That at the nozzle is 60 lbs. What is the pressure loss per section of hose?

Complete Solutions to B Problems

4. You need to find a number N such that 80% of N is $32,500.

80% of N is $32,500

$(0.8)(N) = \$32,500$

$N = \frac{\$32,500}{0.8}$

N = $40,625 So the actual loss was $40,625

5. You need to find 28% of 36

28% of 36 $= (0.28)(36) = 10.08$

So 10 men received injuries

6. You need to find 51.2% of 5,148

51.2% of 5,148 $= (0.512)(5,148) = 2,635.776$

So there were 2,636 burglaries using the rear window.

7. You need to divide the total number of calls by the number of days in a year.

$\frac{85,983 \text{ calls}}{365 \text{ days}} = 235.57 \text{ calls/day}$

Now divide the number of calls per day by the number of hours in a day.

$\frac{235.57 \text{ calls/day}}{24 \text{ hours/day}} = 9.8 \text{ calls/hour}$ So there are about 235.57 calls/day and about 9.8 calls/hour.

8. You need to find an amount A such that 112% of A is equal to $15,650

112% of A = $15,650
$(1.12)(A) = 15,650$

$A = \frac{\$15,650}{1.12} = \$13,973.21$ So the money spent in 1972 amounted to $13,973.21

Complete Solutions to B Problems (continued)

9. You need to find 92% of the original pressure, and add that answer to the original pressure. Then, find 88% of the new pressure, and add that answer to the new pressure.

92% of 54 lbs/sq in = (0.92)(54 lbs/sq in) = 49.68 lbs/sq in

54 lbs/sq in + 49.68 lbs/sq in = 103.68 lbs/sq in

88% of 103.68 lbs/sq in = (0.88)(103.68 lbs/sq in) = 91.24 lbs/sq in

103.68 lbs/sq in + 91.24 lbs/sq in = 194.92 lbs/sq in

So the outlet pressure is 194.92 lbs/sq in

10. You need to find the total number of perfect shots, and then find what percent of the total shots will give us this number.

Officer R	30% of 80	= (0.3)(80)	= 24
S	40% of 70	= (0.4)(70)	= 28
T	60% of 75	= (0.6)(75)	= 45
U	25% of 92	= (0.25)(92)	= 23
V	66 2/3% of 96	= (2/3)(96)	= 64
	Total perfect shots		184

Total shots fired = 413

Percentage = $\frac{184 \text{ shots}}{413 \text{ shots}}$ = 0.4455 = 44.55%

11. First, find the number of problem children

2% of 1,000,000 = (0.02)(1,000,000) = 20,000 problem children

Number of delinquents = 80% of the 20,000 problem children

80% of 20,000 = (0.8)(20,000) = 16,000 delinquents

80% of 16,000 = (0.8)(16,000) = 12,800 criminals

12. You need to find 6.8% of the burglaries, and find 10.1% of the burglaries. Then, find the difference between these two answers.

10.1% of 22,480 = (0.101)(22,480) = 2,270.48 or about 2,270

6.8% of 22,480 = (0.068)(22,480) = 1,528.64 or about 1,529

2,270 burglaries - 1,529 burglaries = 741 burglaries

So there were 741 more burglaries in December of 1969 than in February of 1969.

Complete Solutions to B Problems (continued)

13. You need to find the total percent loss, and then divide by the number of sections of hose.

What percent of 144 lb is 60 lb?

$\% = \frac{60 \text{ lb}}{144 \text{ lb}} = 0.41667 = 41\ 2/3\%$ total loss

Divide this by 12

$\frac{0.41667}{12} = 0.0347 = 3.47\%$ So there is a 3.47% loss per section

A. Problems with solutions.

1. 111,000 pounds of formaldehyde has a concentration of 53.88%. Find the equivalent number of pounds for a concentration of 37.00% which is the standard for the industry. Use the following formula.

$$(\text{solution amount}) \times (\text{percent}) = \begin{pmatrix}\text{equivalent}\\ \text{amount}\end{pmatrix} \times \begin{pmatrix}\text{standard}\\ \text{percent}\end{pmatrix}$$

Definitions: : Hardboard -- wood chip fibers combined with chemicals and pressed into a solid panel.

Formaldehyde -- chemical used in making hardboard resin.
Resin -- chemical used in making hardboard.

Solution: $(\text{solution amount})\ (\text{percent}) = \begin{pmatrix}\text{equivalent}\\ \text{amount}\end{pmatrix}\ \begin{pmatrix}\text{standard}\\ \text{percent}\end{pmatrix}$

$$(111{,}000 \text{ lbs})\ (0.5388) = \begin{pmatrix}\text{equivalent}\\ \text{amount}\end{pmatrix}\ (0.3700)$$

$$59806.8 \text{ lbs} = \begin{pmatrix}\text{equivalent}\\ \text{amount}\end{pmatrix}\ (0.3700)$$

$$\frac{59806.8 \text{ lbs}}{0.3700} = \text{equivalent amount}$$

$$161{,}640 \text{ lbs} = \text{equivalent amount}$$

2. A flask containing a formaldehyde solution weighs 7.6816 grams. The empty flask weighs 5.5742 grams. The formaldehyde concentration percent is obtained by addition of acid in a titration process. 37.25 ml of acid of normality 1.00 is added to the sample in the titration process. Calculate the formaldehyde concentration percent using the following formula:

$$\%\ \text{formaldehyde} = \frac{(\text{ml of acid}) \times (\text{normality}) \times (3.003)}{\text{weight of sample}}$$

Required Accuracy : The percent is usually rounded to the nearest hundredth of a percent.

Definitions: Normality -- unit of measure related to the strength of a chemical solution.

Titration-- chemical process for testing concentration of a solution.
ml -- liquid measure unit of one milliter.
Formaldehyde -- chemical used in making hardboard resin.
Hardboard -- wood chip fibers combined with chemicals and pressed into a solid panel.
Resin -- chemical used in making hardboard.

Solution: Substituting into the formula:

$$\%\ \text{formaldehyde} = \frac{(37.25 \text{ ml})(1.00)\ (3.003)}{7.6816 \text{ gms} - 5.5742 \text{ gms}}$$

$$= \frac{111.86 \text{ gms}}{2.11 \text{ gms}}$$

$$= 53.08\%$$

B. Problems without solutions.

3. A 2 pound sample of wood chips from a truck delivery is baked in an oven for 8 hours. The tray containing the chips weighs 4.575 pounds. The Tray and chips weigh 5.675 pounds after moisture is removed by the baking. Find the moisture-free percent for the sample.

Accuracy : The thousandths digit is rounded to the nearest multiple of five for each moisture-free sample weight. The described sample weighing has been properly rounded.

4. Trucks deliver wet wood chips from mills to a waterfront dock for loading into a transport ship. A load of chips has been sampled and found to be 55% moisture-free. Find the number of bone-dry-units in the load which had a gross weight of 60,460 pounds and a tare weight of 12,200 pounds. Use the following formula:

$$\text{Bone-dry-units} = \frac{(\text{net weight of load})(\text{percent moisture-free})}{2400}$$

Definitions: Gross weight -- weight of the truck with a load of chips.
Tare weight-- weight of the empty truck
Net weight-- the difference of gross weight and tare weight.

B. Problems without solutions.

5. A sample of paper is tested to determine the percent of moisture which it contains. Complete the following worksheet for the given sample and compare to the chart result found in item 9 which was obtained from the computer that monitors the paper production.

1. Wet gross weight (bag and sample)	189.8 gms	
2. Tare weight (bag)	47.8 gms	
3. Net wet weight (1 minus 2)		_____
4. Dry gross weight (bag and sample)	182.0 gms	
5. Tare weight (bag)	47.9 gms	
6. Net dry weight (4 minus 5)		_____
7. Moisture loss (3 minus 6)		_____
8. Percent moisture (7 divided 3)		_____
9. Percent moisture (avg. from chart)	5.48%	
10. Sample percent moisture (from 8)	_____	
11. Difference (9 minus 10)		_____

6. 200,000 pounds of a 53.00% formaldehyde solution is to be delivered to a resin plant which needs to dilute the solution to 50.00% for use in making hardboard resin. How many pounds of water should be added to obtain a 50.00 % solution? Use the following formula.

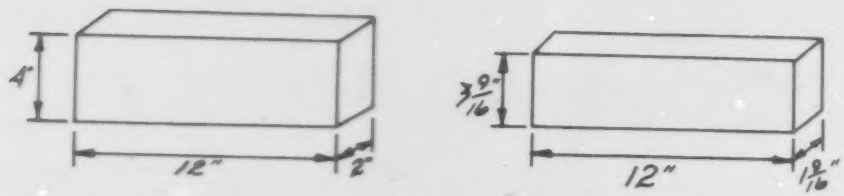
$$(\text{Original solution amount}) \times (\text{percent}) = \begin{pmatrix}\text{orig. soln. amt.}\\ \text{plus added water}\end{pmatrix} \times \begin{pmatrix}\text{diluted}\\ \text{percent}\end{pmatrix}$$

let w represent the pounds of water to be added.

Definitions: Hardboard-- wood chip fibers combined with chemicals and pressed into a solid panel.
Resin-- chemical used to solidify wood fibers into a panel of hardboard.
Formaldehyde-- chemical used in making hardboard resin.

B. Problems without solutions.

7. Each foot of a 2"x4" piece of lumber has a board measure of 2 x 4 x 12 which equals 96 cubic inches or 2/3 board feet. When the piece is surfaced by planing, its dimensions are reduced to 1 9/16" x 3 9/16" x 12". Find the reduced board measure and divide by the original board measure. Carry out the division to five decimal places. The quotient is the net percentage factor for a 2 x 4 which is planed to 1 9/15" x 3 9/16".



Definition: Board measure-- the number of board feet in the piece.

Board feet -- a unit of lumber measurement one foot long, one foot wide, and one inch thick.

B. Problems without solutions:

8. An operator tests samples of formaldehyde used in making hardboard as the chemical is produced. A sample was actually a concentration of 50.10187% and the operator carelessly determines the concentration is 50.00%. Assume that an equal error is made for every test of a weeks production of 772,013 pounds. The subsequent computation results in a considerable error.

a) Find the amount of such an error in pounds of the standard 37% solution. The following is the conversion of the 50.10187% solution to the standard 37% solution.

$$(\text{solution amount}) \times (\text{percent}) = \begin{pmatrix}\text{Equivalent}\\ \text{amount}\end{pmatrix} \times \begin{pmatrix}\text{standard}\\ \text{percent}\end{pmatrix}$$

$$(772{,}013) \times (0.5015187) = \begin{pmatrix}\text{Equivalent}\\ \text{amount}\end{pmatrix} \times (0.3700)$$

$$\frac{386792.94}{0.3700} = \text{equivalent amount}$$

1,045,386 lbs- = equivalent amount

b) Find the cost of the error amount for a value of $.10 per pound.

Definitions: Hardboard --wood chip fibers combined with chemicals and pressed into a solid panel.

37% standard -- concentration of solution which is the basis of pricing for product value.

Complete solutions to B Problems

3. $\left(\frac{\text{Moisture-free weight}}{\text{wet weight}}\right)(100)$ = percent moisture-free.

$$\left(\frac{5.675 \text{ lbs} - 4.575 \text{ lbs}}{2.000 \text{ lbs}}\right)(100) = \text{percent moisture-free}$$

$$\left(\frac{1.100 \text{ lbs.}}{2.000 \text{ lbs.}}\right)(100) = 55\%$$

4. $$\text{Bone-dry-units} = \frac{(\text{net weight of load})(\text{percent moisture-free})}{2400}$$

$$= \frac{(60{,}460 \text{ lbs} - 12{,}200 \text{ lbs})(55\%)}{2400}$$

$$= \frac{(48{,}260 \text{ lbs})(.55)}{2400}$$

$$= 11.0596$$

5.
3 189.8 gms - 47.8 gms = 142.0 gms
6 182.0 gms - 47.9 gms = 134.1 gms
7 142.0 gms - 134.1gms = 7.9 gms
8 7.9 gm/142.0 gms =(.0556)(100) = 5.56%
10 5.56%
11 5.48% - 5.56% = -0.08%

6. $$(\text{Original solution amount})(\text{percent}) = \begin{pmatrix}\text{original soln amt}\\ \text{plus added water}\end{pmatrix}(\text{diluted percent})$$

$$(200{,}000 \text{ lbs})(53\%) = (200{,}000 \text{ lbs} + w)(50\%)$$

$$106000 \text{ lbs} = (200{,}000 \text{ lbs} + w)(50\%)$$

$$\frac{106000 \text{ lbs}}{50\%} = 200{,}000 \text{ lbs} + w\text{lbs}$$

$$212{,}000 \text{ lbs} = 200{,}000 \text{ lbs} + w \text{ lbs}$$

$$212{,}000 \text{ lbs} = 200{,}000 \text{ lbs} + w \text{ lbs}$$

$$12{,}000 \text{ lbs} = w$$

Complete solutions to B problems.

7. Board measure of reduced board equals:

$$\left(1\frac{9}{16}"\right)\left(3\frac{9}{16}"\right)(12") =$$

$$\left(\frac{25}{16}"\right)\left(\frac{57}{16}"\right)(12")$$

$$\frac{17,100}{256} \text{ cu in} = 66.80 \text{ cu in}$$

Converting $\quad \dfrac{66.80 \cancel{\text{cu in}}}{144 \dfrac{\cancel{\text{cu in}}}{\text{bd ft}}} = .46387 \text{ bd ft.}$

$$\frac{\text{reduced board feet}}{\text{original board measure}} = \frac{.46387 \cancel{\text{bd ft}}}{.66667 \cancel{\text{bd ft}}}$$

8. a. (solution amount) (.5000) = $\left(\begin{matrix}\text{equivalent}\\ \text{amount}\end{matrix}\right)\left(\begin{matrix}\text{standard}\\ \text{percent}\end{matrix}\right)$

$$\frac{(772,013 \text{ lbs})\ (.500)}{.3700} = \text{equivalent amount}$$

1,043,260.81 = equivalent amount

Difference equals 1,045,386 lbs - 1,043,260 lbs = 2,125.19 lbs

b) Error cost = (loss amount) (price)

= (2,125.19 ~~lbs~~) ($0.10/~~1~~6)

= $212.52

A. Problems with Solutions

1. If 4.25 pounds of HTH (high test hypochlorite) containing 70 percent available chlorine is dissolved in 30 gallons of water, what is the percent of available chlorine? What is this concentration in mg/l?

Solution:

(4.25 lbs)(0.70) = pounds of available chlorine

$$\text{Percent of available chlorine} = \frac{(4.25)(0.70)(100)}{(30)(8.34)} = 1.19\%$$

As percent means parts per hundred, we then multiply this percent by 1,000,000/100 = 10,000 to find the ppm.
1 ppm = 1 mg/l

$$\frac{1.19}{100} \quad \frac{10,000}{10,000} = \frac{11,900}{1,000,000} = 11,900 \text{ mg/l}$$

2. 2. Just after a slight earthquake it was noticed that a water main had broken open at a joint and was releasing water into the sewer. If the break leaked water at the rate of 2.9 cfs into the sewer for 3.5 hours, what percent of a 1.234 MGD flow was from the break?

Solution:

(cfs)(0.6462) = MGD

This flow took place for 3.5 hours or about 0.15 day

(2.9 cfs)(0.6462)(0.14 day) = 0.2217 = 22.17%

3. The influent BOD is 300 mg/l to a local plant. The primary clarifier removes 35 percent of the BOD. The activated sludge is 80 percent effective and final clarifier is 20 percent effective. What is the efficiency of the plant?

Solution:

The primary clarifier removes 35 percent of the BOD leaving 65 percent BOD. The activated sludge leaves 20 percent BOD and the final clarifier leaves 80 percent of the BOD.

Percent BOD left = (0.65)(0.20)(0.80) = 0.104 = 10.4%
Percent BOD removed = 100 - 10.4 = 89.6%

A. Problems without Solutions (continued)

3. (con't)

Note: This problem was solved without using the 300 ppm BOD. The actual ppm BOD could be calculated in each step of the treatment but would be a needless calculation UNLESS it created better understanding of the removal process.

B. Problems without Solutions

4. Five pounds of HTH-70 percent avialable chrorine-are dissolved in a ten-gallon container. Just before quitting time, the container was checked and found to have only three gallons in it. How many pounds of chlorine had been fed during this period?

5. A total of 6,235 pounds of dry solids are fed to a digester in one day. How many gallons of seven percent sludge does it take to have pumped this quantity of dry solids?

6. How many pounds of solids are added to the digester in 100,000 gallons of sludge that contains 4.2 percent solids by weight?

7. Primary sludge containing 1.5 percent solids is pumped continuously to the digester. If the pumping rate is 20 gpm, how many pounds of solids are added to the digester in a day?

B. Problems without Solutions (continued)

8. Primary effluent with a BOD of 200 ppm is applied to a trickling filter. The effluent BOD is 42 ppm. What is the efficiency of the filter process?

9. Fresh sludge in a sludge bed 50 x 120 contained 17 percent solids. Some time later, a new lab man found the moisture content of this same sludge to be 50 percent. How many pounds of water per 100 pounds of sludge were lost by evaporation as the sludge baked in the sun?

Level 2

10. The Willow Island treatment plant uses the methane produced by the digester to furnish energy for its power plant. They have found that the heat content of the gas averages 575 BTU per cubic foot. Tests have shown that the methane yield is 16.34 cubic feet per pound of volatile solids fed to the digester. Assuming that 77 percent of the solids are volatile, what is the BTU content of 11,750 pounds of sewage solids?

11. A hundred-pound sample of sludge contained 15 percent solids. Ten days later this same sample was found to be 62 percent water. How many pounds of water did the sample lose by evaporation during this period?

B. Problems without Solutions (continued)

12. (a) From the given data below, calculate the percentage dry solids by weight.

	wet	dry	ash
sample + dish	163.35 g	67.90 g	63.99 g
dish	63.35 g	63.35 g	63.35 g
sample			

(b) From the same data, calculate the percentage volatile solids to total solids.

Calculate the percentage volatile solids to the total sample.

(c) If 6000 gallons of raw sludge is pumped daily to the primary digester, how many pounds of solid material is pumped?

(d) If 6000 gallons of raw sludge is pumped daily, how many pounds of organic (volatile) material is pumped?

Complete Solutions to B Problems

4. Chlorine in bleach = (5 lbs)(0.70) = 3.5 lbs

Chlorine per gallon of bleach = $\frac{3.5 \text{ lbs}}{10 \text{ gal}}$ = 0.35 lbs/gal

Chlorine fed = (0.35 lbs/~~gal~~)(7 ~~gal~~) = 2.45 lbs

5. 1 gallon = 8.34 lbs

Gallons pumped = $\frac{6{,}235 \text{ ~~lbs~~}}{(0.07)(8.34 \text{ ~~lbs~~/gal})}$ = 10,680.03 gallons

6. Here, one must know that water weighs 8.34 pounds per gallon. Then, we know that 100,000 x 8.34 pounds of sludge were added to the digester and 4.2 percent of the sludge was solid.

(100,000 ~~gal~~)(8.34 lbs/~~gal~~)(0.042) = 35,028 lbs

7. By pumping 20 gpm, we are pumping 20 x 1440 gallons per day. Each gallon weighs 8.34 pounds and is 1.5 percent solid.

(20 ~~gal~~/~~min~~)(1,440 ~~min~~/day)(8.34 lbs/~~gal~~)(0.015) = 3,603 lbs/day

8. The filter has removed 158 ppm

$\frac{158 \text{ ~~ppm~~}}{200 \text{ ~~ppm~~}}$ = 0.79 = 79%

9. As the sludge was 83 percent water and is now 50 percent, it had to have lost 33 pounds per 100.

Level 2

10. Volatile solids = (11,750 lbs)(0.77) = 9,047.50 lbs

Gas produced = (9,047.50 ~~lbs~~)(16.7 cu ft/~~lb~~) = 151,093.25 cu ft

BTU content = (625 BTU/~~cu ft~~)(151,093.25 ~~cu ft~~) = 94,433,281.25 BTU

Complete Solutions to B Problems (continued)

11. The only thing remaining constant in this problem is the number of pounds of solids in the sample.

Solids = (100 lbs)(0.15) = 15 lbs

A week later the sample contains 38 percent solids.

15 lbs = (0.38)(current weight of sample)
15 lbs = (0.38)(100 lbs - water loss)
15 lbs = 38 lbs - 0.38 water loss

$$\text{Water loss} = \frac{15 \text{ lbs} - 38 \text{ lbs}}{-0.38} = 60.53 \text{ lbs}$$

12. (a) Wet: 163.35 - 63.35 = 100.00 g
Dry: 67.90 - 63.35 = 4.55 g

$$\frac{4.55 \text{ g}}{100.00 \text{ g}} = 4.6\%$$

(b) Ash: 63.99 - 63.35 = 0.64 g
Volatile: 4.55 - 0.64 = 3.91 g

$$\text{Volatile: total solids} = \frac{3.91 \text{ g}}{4.55 \text{ g}} = 86\%$$

Volatile: total sample = (0.046)(0.86) = 0.0396 = 4%

(c) (6,000 gals)(8.34/gal)(0.046) = 2302 lbs

(d) (2,302 lbs)(0.86) = 1,980 lbs or
(6,000 gals)(8.34 lbs/gal)(0.04) = 2,000 lbs

Difference in answers is due to effects of rounding-off figures at various points in calculations

A. Problems with Solutions

1. It is decided that the flow of water through pipe whose opening has a cross sectional area of 18.84 sq in is to be increased. In order to increase the flow the desired amount, it is found that the area must be increased 83%. What will the new cross sectional area be?

   Solution:

   $$\text{New area} = 18.84 \text{ sq in} + (83\%)(18.84 \text{ sq in})$$

   $$= 18.84 \text{ sq in} + (0.83)(18.84 \text{ sq in})$$

   $$= 18.84 \text{ sq in} + 15.64 \text{ sq in}$$

   $$= 34.48 \text{ sq in}$$

2. Out of a lot of 60 castings 5% were rejected because of defects. How many were rejected?

   Solution:

   $$\text{Number of rejects} = (5\%)(60 \text{ castings})$$

   $$= (0.05)(60 \text{ castings})$$

   $$= 3 \text{ castings}$$

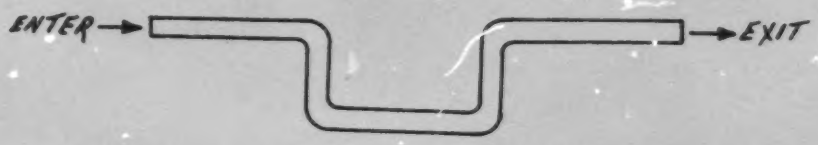
3. A motor receiving 8 hp delivers 6.8 hp of work. What percent of the input is output?

   Solution:

   $$\text{Percent} = \left(\frac{6.8 \cancel{\text{hp}}}{8 \cancel{\text{hp}}}\right)(100) = 85\%$$

B. Problems without Solutions

4. Water begins its flow through a 4 inch diameter pipe system, shown below, at 65 gallons per minute. Each elbow decreases the amount of flow by 0.3%. What is the amount of flow at the end of the system?



5. Steam is forced into a duct work at 70 cu ft/sec. The duct work runs straight for 151 feet. Because of condensation the amount of steam flow is cut 0.04% for every foot of distance traveled. What is the flow at the end of the duct work?

6. At the instant steam enters a pipe system it is flowing at 49.7 cu ft per second. Without insulation, the flow of steam is cut 0.027% due to condensation for each foot of travel. After insulation has been installed, the condensation is cut 50%. If the steam travels 560 feet, by how much will insulation increase the flow?

B. Problems without Solutions (continued)

7. A plant supervisor decided to increase production by 12%. In order to do so, the speed of a certain conveyor belt must be increased by 6.2%. The belt presently travels at a rate of 1 foot per second. If the increase is carried out, what will the new speed of the belt be?

8. In order to increase production by 5.7% the speed of a certain chain must be increased 2%. The present speed is 1 foot per second. If the increase in production is carried out, what will the new speed of the belt be in inches per second?

9. If 15% of a reservoir of lubricating oil is used each hour, in how many hours will the reservoir be empty?

10. A bolt has a rated tensil strength of 20,000 lbs/sq in. Under testing it was found that the bolt broke at 23,000 lbs/sq in. By what percent did the actual strength exceed the rated strength?

B. Problems without Solutions (continued)

11. A machine requiring 35 hp is driven through belts from a 50 hp motor running at capacity. What is the efficiency of the belt drive?

12. In transmitting an input of 80 hp by belts, 1.6 hp is lost by slippage. What percent was lost due to slippage?

13. The efficiency of a motor is 90%, that is, the output is 90% of the input. If the motor delivers 8 hp, what was the input?

14. The indicated horsepower of a steam engine is 9.4 and the effective horsepower is 8.1. What percent of the indicated horsepower is the effective horsepower?

B. Problems without Solutions (continued)

15. Muntz metal is composed of 59.5% copper, 39.9% zinc, and 0.6% lead. How many pounds of each are there in 432 lbs of the alloy?

16. The usual allowance made for shrinkage when casting iron pipe is 1/8" per foot. What percent is this?

17. What must be the length of a pattern for casting a piece 28 1/4" long if the allowance for shrinkage is 3/4 of 1%?

18. A millwright works a 40-hour week at a rate of $5.65 per hour. How much is his takehome pay if 18% is deducted for income tax and 4.2% is deducted for social security?

19. A shop working 8 hours per day for 5 1/2 days per week changes to 9 hours per day for 5 days per week. At the same rate per hour, is the payroll increased or decreased? By what percent?

Complete Solutions to B Problems

4. Flow after first elbow = 65 gal/min - (0.03)(65 gal/min) = 63 gal/min

Flow after second elbow = 63 gal/min - (0.03)(63 gal/min) = 61 gal/min

Flow after third elbow = 61 gal/min - (0.03)(61 gal/min) = 59 gal/min

Flow after fourth elbow = 59 gal/min - (0.03)(59 gal/min) = 57 gal/min

5. Flow lost to condensation = (70 cu ft/sec)(151 ft)(0.04%/ft)

= (70 cu ft/sec)(151 ~~ft~~)(0.0004/~~ft~~)

= 4.23 cu ft/sec

Flow at end = 70 cu ft/sec - 4.23 cu ft/sec = 65.77 cu ft/sec

6. Loss of steam without insulation = (0.027%/ft)(49.7 cu ft/sec)(460 ft)

= (0.00027/~~ft~~)(49.7 cu ft/sec)(460 ~~ft~~)

= 6.17 cu ft/sec

Insulation cuts condensation by 50% of 6.17 cu ft/sec
(0.50)(6.17 cu ft/sec) = 3.09 cu ft/sec

Flow increased by 3.09 cu ft/sec

7. New belt speed = 1 ft/sec + (6.2%)(1 ft/sec)

= 1 ft/sec + (0.062)(1 ft/sec)

= 1.062 ft/sec

8. New speed = 1 ft/sec + (2%)(1 ft/sec)

= 1 ft/sec + (0.02)(1 ft/sec)

= 1.02 ft/sec

= (1.02 ~~ft~~/sec)(12 in/~~ft~~)

= 12.24 in/sec

Complete Solutions to B Problems (continued)

9. 15% is used each hour. We must find how long it takes to use 100%

$$\text{Time to use whole reservoir} = \frac{100\%}{15\%/\text{hr}} = 6\ 2/3\ \text{hr}$$

10. Amount exceeded ratio strength = 23,000 lbs/sq in - 20,000 lbs/sq in

= 3,000 lbs/sq in

$$\text{Percent exceeded ratio strength} = \left(\frac{3{,}000\ \text{lbs/sq in}}{20{,}000\ \text{lbs/sq in}}\right)(100) = 15\%$$

11. $$\text{Percent efficiency} = \left(\frac{\text{output}}{\text{input}}\right)(100)$$

$$= \left(\frac{35\ \text{hp}}{50\ \text{hp}}\right)(100) = 70\%$$

12. $$\text{Percent lost due to slippage} = \left(\frac{1.6\ \text{hp}}{80\ \text{hp}}\right)(100) = 2\%$$

13. $$\text{Percent efficiency} = \left(\frac{\text{output}}{\text{input}}\right)$$

$$(0.90)(100) = \left(\frac{8\ \text{hp}}{\text{input}}\right)(100)$$

$$90 = \frac{800\ \text{hp}}{\text{input}}$$

$$\text{input} = \frac{800\ \text{hp}}{90} = 8.9\ \text{hp}$$

14. $$\text{Percent effective} = \left(\frac{8.1\ \text{hp}}{9.4\ \text{hp}}\right)(100)$$

$$= 86\%$$

15. Amount copper = (59.5%)(432 lbs) = (0.595)(432 lbs) = 257 lbs

Amount zinc = (39.9%)(432 lbs) = (0.399)(432 lbs) = 172.4 lbs

Amount lead = (0.6%)(432 lbs) = (0.006)(432 lbs) = 2.6 lbs

Complete Solutions to B Problems (continued)

16. Percent allowance = $\frac{(1/8 \text{ in/ft})(100)}{12 \text{ in/ft}} = \left(\frac{0.125}{12}\right)(100) = 1\%$

17. Length = 28 1/4" + (0.75%)(28 1/4")

= 28.25" + (0.0075)(28.25")

= 28.25" + 0.21"

= 28.46" = 28 1/2 in

18. Earnings = (40 ~~hr~~)($5.25/~~hr~~) = $210

Takehome = $210 - (18%)($210) - (4.2%)($210)

= $210 - (0.18)($210) - (0.042)($210)

= $210 - $37.80 - $8.82

= $163.38

19. Hours worked in 5 1/2 days = (5 1/2 ~~days~~)(8 hrs/~~day~~) = 44 hrs

Hours worked in 5 days = (5 ~~days~~)(9 hrs/~~day~~) = 45 hrs

So, payroll is increased by 1 hour's wage

Percent increase = $\left(\frac{1 \text{ hr}}{44 \text{ hr}}\right)$ (100) = 2.3%

A. Problems with Solutions

1. A machine shop uses 16 qts of lubricating oil weekly. If 25% of the oil is used for cutting "purposes", what fractional part is used directly on the cutting tool? How many quarts is this?

   Solution:

   $25\% = \frac{25}{100} = 1/4$ of cutting oil used for cutting

   $(1/4)(16\ qt) = 4\ qt$ of oil used for cutting

2. A machine shop casting weighs 64 lbs. Because of an error in the pattern, 16 2/3% must be machined off the casting. How many pounds of cast iron does the machinist remove?

   Solution:

   Need to change 16 2/3% to decimal fraction and then multiply by weight of casting

   $(0.1667)(64\ lbs) = 10.67\ lbs$

   or change 16 2/3% to simple fraction by dividing by 100

   $\frac{16\ 2/3}{100} = \frac{50/3}{100} = \frac{50}{300} = 1/6$

   then $(1/6)(64\ lbs) = 10.67\ lbs$

3. Micrometers are listed at $5.60 each. A 10% discount is allowed if they are purchased by the dozen. If a company purchases 12 of them, what will be the cost of one micrometer?

   Solution:

   Need to figure discounted price

   discounted price = $5.60 - (0.10)($5.60)$ or $(0.90)($5.60)$

   = $5.04 per micrometer

B. Problems without Complete Solutions

4. A machine shop receives 9,384 lbs of steel.

   a) 1,840 lbs is 2" diameter stock
   b) 564 lbs is 2" diameter stock
   c) 1,050 lbs is 1/2" diameter stock
   d) 960 lbs is 1/2" x 2" flat stock
   e) 2,650 lbs is 3/4" x 3/4" square stock
   f) 1,468 lbs is 1/4" x 2" flat stock
   g) 852 lbs is assorted tool steel

   What is the percentage of each?

   Solution:

5. A drill press has 2" belt 8 feet long. The belt breaks, and 1/4 of it was wasted for repairs. What percent of the belt was wasted?

   Solution:

6. A machinist makes 624 bolts. If the inspector "scraps" 72, what percentage of his work is scrapped?

   Solution:

B. Problems without Complete Solutions (continued)

7. A shaper (machine) costs $1,870. If the bill is paid within 30 days a 4 1/2% discount is allowed. The machine is paid for on the 25th day after the purchase. How much, if any, is saved?

Solution:

8. A company purchased a milling cutter, type-slab, 1 1/2" diameter x 1 3/4" with 1" hole. The list price was $7.50, but $5.70 was paid for it. The company had a 10% discount and what additional discount did they get?

Solution:

9. A number of castings were delivered to a machine shop. 468 lbs of castings had "blow holes" and were defective. If the defective castings were 8%, what was the total number of pounds delivered?

Solution:

B. Problems without Complete Solutions (continued)

10. Figure the following bill: Terms of discount are 25% and less 3% for cash. If the bill was not paid in cash, how much did the buyer lose?

4 taps 1/4" diameter @ $0.45 each	$ 1.80
15 drills, taper shank 5/8" diameter @ $2.50 each	37.50
6 combination drills and countersinks size D-2 @ $6.00 per dozen	3.00
3 knife handled wrenches (monkey) 10" long @ $22.00 per dozen	5.50
6 "C" clamps, number 412, throat 5 3/4" @ $6.50 per dozen	3.25
2 number 225 micrometers, 0 to 1" @ $8.50 each	17.00
TOTAL	$68.05

Solution:

Complete Solutions to B problems

4. Need to divide each individual weight by total weight and affix % sign.

a) $\frac{1{,}840 \text{ lbs}}{9{,}384 \text{ lbs}} = 0.196 = 19.6\%$

b) $\frac{564 \text{ lbs}}{9{,}384 \text{ lbs}} = 0.060 = 6.0\%$

c) $\frac{1{,}050 \text{ lbs}}{9{,}384 \text{ lbs}} = 0.112 = 11.2\%$

d) $\frac{960 \text{ lbs}}{9{,}384 \text{ lbs}} = 0.102 = 10.2\%$

e) $\frac{2{,}650 \text{ lbs}}{9{,}384 \text{ lbs}} = 0.282 = 28.2\%$

f) $\frac{1{,}468 \text{ lbs}}{9{,}384 \text{ lbs}} = 0.156 = 15.6\%$

g) $\frac{852 \text{ lbs}}{9{,}384 \text{ lbs}} = 0.091 = 9.1\%$

5. 1/4 of belt was wasted so change to decimal fraction by long division and then convert to percent.

$1/4 = 0.25 = 25\%$

6. Divide number scrapped by total number made. Multiply by 100 (shift decimal point 2 places to right) and affix percent sign.

$$\text{Percent work scrapped} = \left(\frac{72}{624}\right)(100)$$

$$= (0.1154)(100)$$

$$= 11.54\%$$

7. Need to determine amount saved; that is 4 1/2% of $1,870.

$$\text{Amount saved} = (4\ 1/2\%)(\$1{,}870)$$

$$= (0.045)(\$1{,}870)$$

$$= \$84.15$$

8. Total discount = $7.50 - $5.70 = $1.80

Company discount = (10%)($7.50) = (0.10)($7.50) = $0.75

Additional discount = total discount - company discount

= $1.80 - $0.75 = $1.05

$$\text{Percent additional discount} = \frac{\text{additional discount}}{\text{discounted price}}$$

$$= \frac{\$1.05}{\$5.70} = 18.4\%$$

Complete Solutions to B problems (continued)

9. The number of defective castings divided by the % of defective castings will give total weight.

$$\text{Total weight} = \frac{468 \text{ lbs}}{8\%} = \frac{468 \text{ lbs}}{0.08} = 5{,}850 \text{ lbs}$$

Alternate Solution:

$$\text{Percentage} = (\text{rate})(\text{base}) \qquad P = rb$$

$$468 \text{ lbs} = (0.08)(b)$$

$$\frac{468 \text{ lbs}}{0.08} = b$$

$$5{,}850 \text{ lbs} = b$$

10. Amount of bill after 25% discount = \$68.05 - (0.25)(\$68.05)

= \$68.05 - \$17.01

= \$51.04

Amount discount for cash = (3%)(\$51.04) = (0.03)(\$51.04)

= \$1.53

So, lose \$1.53 for not paying cash

Amount paid if paid in cash = \$51.04 - \$1.53 = \$49.51

A. Problems with Solutions

1. The force required to push a clutch pedal down is 36 lbs. If the overcenter (helper) spring decreases this force to 11 3/4 lbs, what percentage of the work does the overcenter spring do?

   Solution:

$$\text{Work done by overcenter spring} = \frac{36 \text{ lbs} - 11.75 \text{ lbs}}{36 \text{ lbs}}$$

$$= \frac{24.25 \cancel{\text{ lbs}}}{36 \cancel{\text{ lbs}}}$$

$$= 0.67 = 67\%$$

2. Some acrylic lacquers call for a 150% reduction. If 1 pint thinner to 2 pints lacquer is a 50% reduction (50% of the original lacquer volume added), how much thinner must be added to make a 150% reduction? What percent of the final mixture is the lacquer?

   Solution:

   150% of 1 quart is 3 pints. Three pints of thinner is added to the original 2 pints lacquer to make a 150% reduction.

   Final mixture = 2 pints lacquer + 3 pints thinner = 5 pints

$$\text{Lacquer in final mixture} = \frac{2 \cancel{\text{ pints}}}{5 \cancel{\text{ pints}}} = 0.4 = 40\%$$

3. An enamel paint specifies that for a spray gun of 60 PSI, the paint should be reduced by mixing 1 pint reducer for each quart of paint. What percent of original volume is beint added? What percent of final mixture is reducer?

   Solution:

$$\text{Volume added} = \frac{1 \cancel{\text{ pint}}}{2 \cancel{\text{ pint}}} = 0.5 = 50\%$$

$$\text{Reducer in final mixture} = \frac{1 \cancel{\text{ pint}}}{3 \cancel{\text{ pint}}} = 0.333 = 33\ 1/3\%$$

B. Problems without Solutions

4. 70 PSI of air is required to operate a given spray gun with acrylic enamel. If the compressor produces 80 PSI but the hose loss is 15% per 50 ft, how much hose can be used and still retain good performance?

5. A 1963 P-30 Chevrolet specifies a 28 gal/min gravity flow in the radiator. A truck that was stopped by boil over was found to have a 19 gal/min flow. What percent was lost and what safety margin was built into the radiator?

6. A 1963 Chevrolet truck P-30 radiator specifies a 28 gal/min gravity flow. In hard use a truck with 24 gal/min flow ran higher than normal temperature. At that time how much was the flow impared in gallons per minute? What percent was that of the total gravity flow?

7. A tire when new had a tread depth of 11/32". If at 14,000 miles of use it has 9/64" of tread left, what percent of the tread is left?

B. Problems without Solutions (continued)

8. The brake lining on a new car is 7/32" thick. At the 20,000 mile service check the rear brakes are found to be 5/64" thick. What percent of the brake lining has worn away? How many miles should the car be driven before a brake reline?

9. The price of a gallon of gasoline is 42.9 cents. The state tax is 7 cents, the federal tax is 4 cents, the station profit is 3.8 cents, and the bulk station profit is 2.62 cents. What does the bulk dealer pay per gallon? What percent of the selling price does each of the selling price does each of the "middlemen" get?

10. A truck tire size 700 x 16.5 @ $98.64 has an original tread depth of 17/32". If the tread separates at 13/32" tread depth, what will the cost of adjustment be to the owner? Consider the margin of profit at 25%. What does the dealer profit on the adjustment?

B. Problems without Solutions (continued)

11. If a 400 cubic inch engine was operating at 0.24 volumetric efficiency and was turning at 3400 RPM at 60 mph, how many cubic feet of air would be pumped through the engine in one mile? How much oxygen? (Air is 21% oxygen.)
Definitions: 400 cu in engine: a 400 cu in engine will take in 400 cubic inches of air in complete cycle or two revolutions.

Complete Solutions to B Problems

4. It is possible to have a 10 PSI loss (80 - 70 = 10).

$$\text{Possible loss} = \frac{10 \cancel{\text{PSI}}}{80 \cancel{\text{PSI}}} = 0.125 = 12.5\%$$

x = feet of hose

$$\frac{50 \text{ ft}}{15\% \text{ loss}} = \frac{x}{12.5\% \text{ loss}}$$

$$15x = 625 \text{ ft}$$

$$x = \frac{625 \text{ ft}}{15} = 41.67 \text{ ft}$$

5. $$\text{Loss} = \frac{28 \text{ gal/min} - 19 \text{ gal/min}}{28 \text{ gal/min}}$$

$$= \frac{9 \cancel{\text{gal/min}}}{28 \cancel{\text{gal/min}}} = 0.32 = 32\%$$

$$\text{Safety margin} = \frac{28 \cancel{\text{gal/min}}}{19 \cancel{\text{gal/min}}} = 1.47$$

6. Impairment = 28 gal/min - 24 gal/min = 4 gal/min

$$\text{Impairment} = \frac{4 \cancel{\text{gal/min}}}{28 \cancel{\text{gal/min}}} = 0.1428 = 14.3\%$$

7. $$\text{Tread left} = \frac{9/64 \cancel{\text{in}}}{11/32 \cancel{\text{in}}} = \left(\frac{9}{64}\right)\left(\frac{64}{22}\right) = \frac{9}{22} = 0.41 = 41\%$$

8. $$\text{Brake lining left} = \frac{5/64 \cancel{\text{in}}}{7/32 \cancel{\text{in}}} = \left(\frac{5}{64}\right)\left(\frac{64}{14}\right) = \frac{5}{14} = 0.357 = 36\%$$

Lining worn away = 100% - 36% = 64%

The brakes should be relined very soon. Do <u>not</u> depend on the same rate of wear.

Complete Solutions to B Problems (continued)

9. Bulk dealer's cost = \$0.429 - (\$0.07 + \$0.04 + \$0.038 + \$0.0262)

= \$0.429 - \$0.1742

= \$0.2548

State = $\frac{\$0.07}{\$0.429}$ = 0.163 = 16.3%

Federal = $\frac{\$0.04}{\$0.429}$ = 0.093 = 9.3%

Station = $\frac{\$0.038}{\$0.429}$ = 0.089 = 8.9%

Bulk station = $\frac{\$0.0262}{\$0.429}$ = 0.061 = 6.1%

10. Tread used by owner = 17/32" - 13/32" = 4/32 in

Tread used by owner = $\frac{4/32 \text{ in}}{17/32 \text{ in}}$ = 4/17 = 0.2353 = 23.53%

Owner's cost of adjustment = (23.53%)(\$98.64)
= (0.2353)(\$98.64)
= \$23.21

Dealer's profit = (0.25)(\$23.21) = \$5.80

11. (0.24)(400 cu in) of air would go through the engine in two revolutions. The engine would make 3,400 revolutions per mile.

Air = (0.24)(400 cu in/~~rev~~)(1,700 ~~rev~~/mile)
= 163,200 cu in/mile

Air = $\frac{163,200 \text{ ~~cu in~~/mile}}{1,728 \text{ ~~cu in~~/cu ft}}$ = 94.44 cu ft/mile

Oxygen = (94.44 cu ft/mile)(0.21) = 19.83 cu ft/mile

A. Problems with solutions.

1. A resistor shows signs of overheating, but appears to be useable. Its color code is A 270K OHM, 5% device. Ohmmeter readings taken with the Simpson multimeter give the value of resistance,R, as 289K OHMs. Ignoring errors in the instrument, determine:

   a) Is the resistor within tolerance?
   b) If not, by what percent does its resistance exceed tolerance?

   Solution:

   a) Finding acceptable upper limit of resistance
   (270,000 OHMS) (105%) = 283,500 OHMS

   The resistance exceeds tolerance.

   b) Finding percent by which the actual resistance exceeds tolerance
   Nominal resistance = 270,000 OHMs
   Ohmmeter Reading = 289,000OHMs
   Difference = 19,000 OHMs

   $$\% \text{ Actual R of nominal R} = \left(\frac{19{,}000 \text{ OHMs}}{270{,}000 \text{ OHMs}}\right)(100) = 7\%$$

   % Actual R exceeds tolerance = 7% - 5% = 2%

B. Problems without solutions.

2. The cost of electricity is 0.014 per KWH. You are about to put your new amateur rig on thea air, consisting of a transmitter which draws 150 Watts continuous power (increasing by 75% when keyed), and a receiver which draws 130 Watts continuous power. You estimate that you will be on the air for two hours per day with the transmitter keyed half of that time.

   Determine the cost of operating the rig over a period of 30 days.

Complete solutions to B problems.

2. a) Power used by Receiver $= (130 \text{ Watts}) \left(\frac{2 \text{ hours}}{\text{day}} \right) (30 \text{days}) = 7800 \text{ Watts Hrs.}$

b) Power used by Transmitter:

Unkeyed: Power $= (150 \text{Watts}) \left(\frac{2 \text{ hours}}{\text{day}} \right) (30 \text{ days}) = 9000 \text{ Watt Hrs.}$

Keyed: Power $= (150 \text{ Watts})(0.75) \left(\frac{1 \text{ hour}}{\text{day}} \right) (30 \text{ days}) = 3375 \text{ Watt Hrs.}$

Total Power 20,175 Watt Hours

= 20,175 KWH

Cost of Power used $= (20.175 \text{ KWH}) \left(\frac{\$0.014}{\text{KWH}} \right) = \$0.282$ per month

A. Problems with Solutions

1. To find the mechanical efficiency of an engine, you divide the brake horsepower by the factory specified indicated horsepower. If the brake horsepower of an engine is 155 and the indicated horsepower is 185, what is the percent of mechanical efficiency?

   Solution:

   $$\frac{155}{185} = .8378 = 83.8\% \text{ to nearest tenth of a percent.}$$

2. A dealer placed a $1,635.00 parts order with a distributor. A 15% discount was to be allowed on the purchase. When the dealer received the invoice for $1,487.85 he was sure that it had been incorrectly discounted. On checking he found that his suspicions were correct.

   (a) What percent was actually allowed?

   (b) At the correct 15% discount, what should his billing have been?

   Solution:

   (a) $\$1,635.00 - \$1,487.85 = \$147.15$

   $$\frac{\$147.15}{\$1,635.00} = .09 = 9\%$$

   (b) Since 15% off is the same as 100% - 15% = 85%

   then, $(\$1,635)(.85) = \$1,389.75$

3. It is reported that energywise, diesel fuel has about 137,000 BTU per gallon compared to 123,000 BTU for gasoline. What is the nearest percent of saving in terms of energy of diesel compared to gasoline?

   Solution:

   $$\frac{137,000 - 123,000}{123,000} = .1138 \approx 11.4\%$$

B. Problems without Solutions

4. A customer has a warranty claim on an item costing $397.29. Upon failure analysis, it was decided that only 25% of the claim was warranty. What was the value of the credit he received on his account?

5. Rolling resistance is expressed in pounds per 1000 pounds of gross vehicle weight. On a clean flat surface this amounts to about 15 pounds. So, the percent of rolling resistance is 1.5%. On a loose sand or gravel surface the percent rolling resistance is 10%. Find the pounds of resistance per 1000 pounds of gross vehicle weight.

6. It is claimed that in 15,000 hours, or six years, a gasoline engine will be down 32 days for routine maintenance (a typical gasoline carburetor and ignition system has 411 parts while the Cummins PT system has only 275 parts) while a diesel will be down only 13 days. This means what percent less routine maintenance downtime with diesel?

7. When estimating the horsepower of supercharged engines with the vehicle on a certain kind of chassis dynamometer, 25% should be derated for parasitical loads, 3% for each 1,000 feet increase in altitude above sea level and 1% for each 10 degrees above 60 degrees F. This is accomplished by adding the total percentages for deration and multiplying the maximum horsepower by this figure. Then, subtract this amount from the maximum horsepower of 300 at 2100 rpm develop on a chassis dynamometer?

B. Problems without Solutions (continued)

8. The figures below represent an average based on many customer reports and the data compiled by the Guaranteed Maintenance Department, Cummins Engine Company, Inc.

In 6 years, 15,000 hours, or 500,000 miles you will save $1,950 as shown below:

	Diesel	Cost	Gasoline	Cost
Tune-ups	5	$250	15	$375
Carburetor rebuilds	0		5	125
Engine rebuilds	2	2400	2	1100
New engine	0		2	3000
Total		$2650		$4600

The table shows a saving on the cost of maintaining a diesel engine over a gasoline engine. What is the percent of saving of the diesel compared to the gasoline engine? (nearest whole percent)

9. To avoid low-charged batteries, the total load ampere-hours should be less than 80% of the generated ampere-hours of the alternator system. The remaining 20% of the generated capacity is for charging the battery. If 316 ampere-hours represents 80% of the desired rating, what should the total load ampere-hours be?

B. Problems without Solutions (continued)

10. The volumetric efficiency of an engine refers to the quantity of air taken into a cylinder on an intake stroke as compared with the actual piston displacement. This is expressed in the formula:

$$\text{Volumetric Efficiency} = \frac{\text{air intake (cubic inches)}}{\text{piston displacement (cubic inches)}}$$

Suppose the air actually taken into the combustion chamber is 360 cu in and the piston displacement of the engine is 450. What is the volumetric efficiency expressed in percent?

Level 2

11. The consumption of lubricating oil is 9 gallons per day, and the cost of the oil is 58 cents per gallon. Another quality of oil is substituted which costs 25 percent less, but of which 20 percent more is used. Which oil is cheaper to use and what is the difference in cost per day?

Complete Solutions to 8 Problems

4. (0.25)($397.29) = $99.32

5. (1,000 lbs)(10%) = 100 lbs

6. $\frac{32 \text{ days} - 13 \text{ days}}{32 \text{ days}} = \frac{19}{32} = 0.594 = 59.4\%$

7. Since the alt is 6,000, the percentage to be derated for altitude is (6)(3%) = 18%.

Since 75 degress is 15 degrees above 60 degrees, then, (1 1/2)(1%) = 1.5%

The deration for parasitical loads is 25%

Total deration = 18% + 1.5% + 25% = 44.5%

44.5% of 300 hp = (0.445)(300 hp) = 133.5 hp

then, 300 hp - 133.5 hp = 166.5 hp

8. $\frac{\$4,600 - \$2,650}{\$4,600} = .4239$ or 42%

9. $\frac{316 \text{ amp-hours}}{0.80} = 395$ ampere-hours

10. Volumetric Efficiency = $\frac{\text{air intake}}{\text{piston disp}} = \frac{360 \text{ cu in}}{450 \text{ cu in}} = 0.80 = 80\%$

11. Cost of first oil is (9 gal/day)($0.58/gal) = $5.22/day

Cost of second oil is 25% less or (0.75)($0.58) = $0.4350/gal

Since 20% more cheap oil is used, then, 9 gal/day + 0.20(9) = 10.8 gal/day is used

($0.4350/gal)(10.8 gals/day) = $4.70/day

$5.22 - $4.70 = $0.52 per day

B Problems without Solutions

1. The data taken for an in-place density test is as follows:

Volume of the Hole	0.120 cu ft
Sample Wt (wet) of 3/4" minus material	15.0 lbs
Moisture content of 3/4" minus material	31%
Gradation	
100% passin g 1-1/2"	
95% passing 3/4"	
80% passing #4	
Volume	
+ 3/4" material	0.005 cu ft
+ #4 to -3/4" material	0.010 cu ft

The moisture-density results for this material are as follows:

Compaction by AASHO T 99 Method D	= 6" Moid and 3/4" Matl
Maximum density	= 108 pcf
Optimum Moisture	= 30%

Calculate the percent relative density for this data.

Complete Solutions to B Problems

1. Maximum Density = 108 pcf

Optimum Moisture = 30%

95% of Maximum Density = (0.95)(108 pcf) = 102.6 pcf

Percent of Relative Density:

$$\frac{30\%}{108 \text{ pcf}} = \frac{x}{102.6 \text{ pcf}} = 28.5\%$$

A. Problems with solutions

1. An electric utility company specifies that all components of line pole bracing shall be installed with a saftey factor of 1.67. This means that the permitted load must be less than 60% of the ultimate strength of the component. What are the maximum permitted loads for the following?

Component	Minimum Breaking Strength without Safety Factor in Pounds	Maximum Permitted Load
1. $\frac{1}{4}$" steel strand, utility grade	2,500	
2. $\frac{5}{16}$" steel strand, utility grade	6,000	
3. $\frac{5}{8}$" anchor rod, twin eye	15,000	
4. Porcelain breakers 1-34-325	20,000	
5. Fiberglass breakers 1-34-300	21,000	

Solution:

1. (0.6)(2,500lbs) = 1,500lbs
2. (0.6)(6,000lbs) = 3,600lbs
3. (0.6)(15,000lbs) = 9,000lbs
4. (0.6)(20,000lbs) = 12,000lbs
5. (0.6)(21,000lbs) = 12,600lbs

B. Problems without solutions

2. What is the efficiency of a motor-generator if the input is 1500 watts and the motor-generator losses total 250 watts?

B. Problems without solutions

3. A resistor rated at 20 ohms is checked by an accurate bridge and measures 20.05 ohms. What is the percent error of the resistor?

Level II

4. What normal current load, in amperes, should be figured for a 220-volt, 5 horsepower dc motor having a 90% efficiency?

Power Formula: P= IE

Complete solutions to B problems

2. Efficiency = $\frac{\text{output}}{\text{Input}} \times 100\%$

$= \frac{(1500-250)\ \text{watts}}{1500\ \text{watts}} \times 100\% = \underline{83\%}$

3. % error = $\frac{\text{error}}{\text{correct value}} \times 100\%$

$= \frac{(20.05-20)}{20.05} \times 100\%$

$= \underline{0.25\%}$

4. Power Formula: $P = IE$

$(5\text{hp})\left(\frac{746\text{w}}{\text{hp}}\right) = I(220\text{v})$

$I = \frac{(5)\ (746)\text{w}}{220\text{v}} = \underline{16.95\text{A}}$

$90\%\ I = (.90)(16.95\text{A}) = \underline{15.26 \text{ amperes}}$

A. Problems with Solutions

1. The price of 1" x 1" x 1/4" steel bar is regularly $00.235 per pound. A welding shop bought 1200' of stock and received a 5% discount. If the bar weighs 29.8 lbs per 20' bar, find:

   (a) the regular price.

   (b) the discount price.

   (c) the cash saving.

   Solution:

   Need to find the number of 20 foot bars there are in 1200 feet and then multiply by the weight per 20' bar.

   $$\frac{1200\ \cancel{ft}}{20\ \cancel{ft}/\text{bar}} = 60 \text{ bars}$$

   (60)(29.8 lbs) = 1788 lbs

   Now multiply by the cost per pound
   (1788 ~~lbs~~)($0.235/~~lb~~) = $420.18
   To compute the 5% discount, we can take 95% of 420.18

   (0.95)($420.18) = $399.17

   (a) regular price is $420.18
   (b) discount price is $399.17
   (c) cash savings is $420.18 - $399.17 = $21.01

B. Problems without Solutions

2. The cost for the steel for a given job is $1,043. The steel supplier for your shop has anticipated an 8% rise in the price of all steel within the next month. What will the new cost of materials be for the given job?

   Solution:

B. Problems without Solutions (continued)

3. The bill for a certain welding job is $322.20. If the customer wishes to pay 15% on the original bill, what should he pay?

   Solution:

4. A $191.10 charge for a welding job represents 22.5% of the total cost. What did the job cost?

   Solution:

Complete Solutions to B Problems

2. Need to find 8% of the total cost and add the resulting amount back to the total cost.

($1,043)(0.08) = 83.44

$1043 + $83.44 = $1126.44

An alternate solution is to multiply 108% by the total cost.

($1043)(1.08) = $1126.44

So the new cost is $1126.44

3. Need to find 15% of $322.20

(0.15)($322.20) = $48.33

The customer will have to pay at least $48.33

4. Need to find the total cost if 22.5% of the total cost is $191.10

0.225 x total cost = $191.10

$$\frac{(0.225)(tc)}{0.225} = \frac{\$191.10}{0.225}$$

$$TC = \frac{\$191.10}{0.225}$$

= $849.33 So the total cost is $849.33

A. Problems with solutions.

1. Debbie Elliott has money in a bank which pays 5% simple interest. She realizes $1000 interest per year from her savings. How much does she have in the bank?

Solution:

$$\frac{I}{R} = A$$

$$\frac{\$1000}{.05} = \$20{,}000 \text{ (ans)}$$

2. Harry Linx purchased an apartment building for $60,000. He receives $7000 each year for rent. The quarterly expensed total $450. What percent does the investment pay?

Solution:

$$\$7{,}000 - (4)\ (\$459.00) = \$5{,}200 = \text{net income}$$

$$\frac{\$5{,}200}{\$60{,}000} = 0.09 = 9\%$$

3. A contractor sold a home for $17,000 which represents 12% profit on his original investment. What was his original investment?

Solution : 100% investment + 12% = 112% or 1.12

$$\frac{\$17{,}000}{1.12} = \$15{,}178.57$$

4. A bank agreed to lend a home owner a sum equal to 80% of the appraised valuation at 6% interest per year. The first year he received $300 in interest. What was the value of his property?

Solution:

$$\frac{\$300.00}{0.06} = \$5{,}000 = 80\%$$

$$\frac{\$5{,}000}{0.80} = \$6{,}250$$

B. Problems without solutions.

5. Pete Cane recieves 5% on his investment. The annual rent collected by him is $20,000 and his operating expenses are $15,000 per year.

   a) What is the value of his investment?
   b) If his equity is 60% of its value, what rate of return is he getting on his equity?

B. Problems wihtout solutions.

5. continued.

6. A man sold a lot for $12,000 which was 12% over his investment. What was his investment?

7. A yearly interest rate of 3 1/2 % produces $28.50 income each month. What is the amount owed?

B. Problems without solutions.

8. Harrey O'Shea owns an apartment building. His semi-annual net income from it is $4000. The rate of income expected is 7%. What is the value of the property?

9. A farm sold for $85,500 and the brokerage fee was $2140. What was the rate of the brokerage fee?

10. $2400 is equal to 8% of the price of a house. What is the price of the house?

11. $437.50 is 6 1/4% of what amount?

B. Problems without solutions.

12. On a loan with a balance of $8,500 and an interest rate of 8 3/4%, what would the quarterly payments be?

13. Mr. Kade pays $28.50 interest each month at annual interest rate of 7 1/2%. What is the principal of his loan?

14. $31.34 is what percent of $545?

15. From sale of land you receive $135 each month, of which $85 is interest. Your interest rate is 6% per year. What is the total amount owed for the land?
(Hint: Amount owed is determined by interest and rate. Profit has no bearing.)

B. Problems without solutions.

16. A business property valued at $100,000 is to earn 15% gross return on the total investment. What would be the gross monthly income?

17. A home sold for $12,500 at a 23% profit. What did the house cost?

18. $1080 is 9% of what amount?

19. If the annual taxes are $1090 on an assessed value of $54,500, what is the tax millage rate?

5. a) Income per year = $20,000 - $15,000 = $5,000

$$\frac{\$5000}{0.05} = \$100,000$$

b) (0.60)($100,000) = $60,000

$$\frac{\$5000}{\$60,000} = 0.08 = 8\%$$

6. $$\frac{\$12,000}{1.12} = \$10,714.29$$

7. ($28.50)(12) = $342.00

$$\frac{\$342}{0.035} = \$9,771.43$$

8. ($4,000)(2) = $8,000.00

$$\frac{\$8,000}{0.07} = \$114,285.71$$

9. $$\frac{\$2,140}{\$85,500} = 0.03$$

10. $$\frac{\$2,400}{0.08} = \$30,000$$

11. $$\frac{\$437.50}{0.0625} = \$7,000$$

12. ($8,500)(0.0875) = $743.75

$$\frac{\$743.75}{4} = \$185.94$$

13. ($28.50)(12) = $342.00

$$\frac{\$342.00}{0.075} = \$4,560.00$$

14. $$\frac{\$31.34}{\$545} = 0.0575 = 5.75\% = 5\ 3/4\%$$

Complete solutions to B problems.

15. $(\$85)(12) = \$1,020$

$$\frac{\$1,020}{0.06} = \$17,000$$

16. $(\$100,000)(0.15) = \$15,000.00$

$$\frac{\$15,000}{12} = \$1,250$$

17. $$\frac{\$12,500}{1.23} = \$10,162.60$$

18. $$\frac{\$1,080}{0.09} = \$12,000.00$$

19. $$\frac{\$1,090}{\$54,500} = 0.02 = 20 \text{ mills}$$

PERCENT
COMMISSION
Level I

A. Problems with solutions.

1. A broker is to receive a 6% commission on a $20,000 sale. What will his brokerage fee be?

   Solution:

   ($20,000)(0.06) = $1,200

2. A parcel of land sold for $4750. The brokerage rate was 5% and the salesman received 35% of the brokerage fee. What will the salesman receive?

   Solution:

   ($ 4,750) (.05) = $237.50 = brokerage fee
   ($ 237.50) (.35)= $83.13 = salesman's pay

3. It is agreed that 10% of all sales fees collected by the office will go to the sales manager. The balance of all fees is divided as follows: 30% to the employing broker, and the balance to the salesman.
   A salesman sold a home for $35,000 at 6% brokerage fee. How much will the salesman receive?

   Solution:

   ($35,000) (0.06) = $2100.=total fee

   $2,100.00 - (0.10) ($2,100.00)= $1,890.00

   the broker's 30% = (0.30) ($1,890.00) =$567.00

   $ 1,890.00 - $567.00 = $1,323.00 = salesman's pay

4. A salesman brings in a listing on a $25,000 home and is to receive 10% of the total 7% brokerage fee when the property sells. If another salesman sells the house and the 10% is deducted from his half of the sales fee:

   (a) How much would the listing salesman receive?

   (b) How much would the selling salesman receive?

Solution:

a) ($25,000) (0.07) = $1,750.00

   ($1,750) (0.10) = $175.00

b) ($1,750) (0.50) = $875.00

   $875.00 - $165.00 = $700.00

B. Problems without solutions.

5. A lot with 95 front feet sells at a rate of $24 per front foot. If the broker's fee is 8% and the salesman's share is half the broker's total, how much will the salesman receive?

6. A salesman's half of a 6% sales fee on a $15,000 sale would amount to how much after the deduction of a multiple fee of $150 from the total fee?

7. A sales fee of 8% is charged on a $11,700 sale. The salesman is to receive 1/6 of the total fee. What would this amount to?

8. The listing salesman is to receive 35% of the total brokerage fee when the property is sold. If the brokerage fee is 7% of the sales price and a property is sold for 85% of the listed $11,000, what will the listing salesman receive?

B. Problems without solutions.

9. A salesman is employed on an arrangement whereby he is to receive 50% of all brokerage fees that are received by the office. If a listing on a 220 acre farm is sold at $750 per acre and the brokers fee is 10% on the first $50,000 and 8% on the next $20,000 and 7% thereafter, what would the salesman receive?

10. Mr. Bennett leased a store to Mr. Akeson on a percentage lease. The lease called for Mr. Akeson to pay Mr. Bennett a minimum guaranteed rental of $250 per month and 4% of all business in excess of $75,000 per year. At the end of the year, Mr. Akeson had done a total volume of $135,000. How much rent must he pay for the year?

11. A 9% brokerage fee is collected on the sale of a house for $27,600. The fee is distributed as follows: 60% to the broker, and 40% to the salesman. How much does each party collect?

B. Problems without solutions.

12. Mr. Zagg is to receive 60% of an 8% brokerage fee on a $28,500 sale. What amount will he receive?

13. What is the brokerage fee on a property selling for $9500 if 8% is paid on the first $5000 and 3 1/2% on the remaining amount?

14. A broker agreed to give his salesman 1/6 of the sales fee for a listing and 1/3 of the fee for selling. At 7% sales rate what would a salesman receive for selling his own listing on a property for $11,700?

15. You listed the N1/2 of NE1/4 of SW1/4 of section 10 at $400 per acre. Your brokerage fee is 8%. How much would you make? Note: 1 section = 640 acres.

B. Problems without solutions.

16. The sales manager is to receive 20% of the selling salesman's 70% of the total brokerage fee. A building valued at $65,000 is sold with a brokerage fee of 7%. What is the sales manager's share?

17. A lot 105 ft 9in by 150 ft sold for 23¢ a square foot, and the brokerage fee was 7%. What is the broker's share if he is to receive 40% of the total fee?

18. What is the brokerage fee for each person in the following example? The broker receives 10%,each of two salesmen receive 30% of the broker's fee, and the sale was for $20,000.

19. A lot having a frontage of 60 ft and a depth of 80 ft is sold for $25 per front foot. What is the broker's fee if he is to receive 7%?

B. Problems without solutions.

20. What is the broker's fee on 150 front feet at $90 per front foot, with a 10% fee on the first $4500 and a 2 1/2% fee on the balance?

21 A broker leases a store for a client for one year at a monthly rental of $400. What fee is due him at the rate of 7 1/2% of the total?

22. A salesman listed a home for $35,000 and is to receive 10% of the brokerage fee when it is sold. It was sold by another salesman for a brokerage fee of 6%. The listing salesman's fee is deducted from the selling salesman's half of the total fee. How much will each of the two samesmen receive?

Complete solutions to B problems.

5. $(95 \text{ ft}) \left(\frac{\$24.00}{\text{ft}}\right) = \$2,280$

$(\$2,280)(0.08) = \$182.40$

$\frac{\$182.40}{2} = \$91.20$

6. $(\$15,000)(0.06) = \$900.00$

$\$900.00 - \$150.00 = \$750.00$

$\frac{\$750.00}{2} = \$375.00$

7. $(\$11,700)(0.08) = \$936.00$

$1/6 = 0.17$

$(\$936.00)\ (0.17) = \$156.00$

8. $(\$11,000)\ (0.85) = \$9,350.00$ = sales price

$(\$9,350)\ (0.07) = \$654.50$ = brokerage fee

$(\$654.50)\ (0.35) = \$229.08$ = salesman's share

9. $(220 \text{ acres}) \left(\frac{\$750.00}{\text{acre}}\right) = \$165,000.00$

$(\$50,000)(0.10) = \$5,000$

$(\$20,000)\ (0.08) = \$1,600$

$(\$95,000)(0.07) = \$6,650$

Total = $13,250

$165,000
- 70,000
$95,000

Salesman's share = 50% of total

= (0.50) ($13,250)

= $6,625

Complete solutions to B problems.

10. Guaranteed rental = ($250.00)(12) = $3,000.00

$135,000 - $75,000 = $60,000

($60,000) (0.04) = $2,400 = excess rental

$3,000.00 + $2,400.00 = $5,400.00 total rent

11. ($27,600)(0.09) = $2,484.00

($2,484.00) (0.60) = $1,490.00 = broker's share

$2,484.00 - $1,490.00 = $993.60 = salesman's share

12. ($28,500) (0.08) = $2,280

($2,280) (0.60) = $1,368.00 = total received

13. ($5,000) (0.08) = $400.00

$9,500 - $5,000 = $4,500

($4,500) (0.035) = $157.50

$400.00 + $ 157.50 = $557.50 = brokerage fee

14. ($11,700) (0.07) = $819.00

Salesman's share = 1/3 + 1/6 = 2/6 + 1/6 = 3/6 = 1/2 of total

($819.00) (0.50) = $409.50

15. SW1/4 = (0.25) (640) = 160 acres

NE1/4 = (0.25) (160) = 40 acres

N1/2 = (0.50) (40) = 20 acres

$$(\ 20\ \text{acres}\ )\left(\frac{\$900.00}{\text{acre}}\right) = \$18,000$$

($18,000) (0.08) = $1,440.00 = brokerage fee

Complete Solutions to B Problems.

16. ($65,000)(0.07) = $4,550 = brokerage fee

($4,550) (0.70) = $3,185.00 = selling salesman's 70%

($3,185)(0.20) = $637.00 = sales manager's 20%

17. 105 ft 9 in = 105.75 ft

(105.75 ft) (150 ft) = 15,862.5 sq. ft

(15,862.5 ~~sq ft~~) (.23/~~sq ft~~) = $3,648.38 = sales price

($3,648.38) (0.07) = $255.39 = total fee

($255.34)(0.40) = $102.15 = broker's fee

18. ($20,000)(0.10) = $2,000.00

($2,000.00) (0.30) = $600 for each salesman for a total of $1,200

$2,000.00 - $1,200.00 = $800.00 = broker's share

19. (60 ~~ft~~) $\left(\frac{\$25.00}{\text{ft}}\right)$ = $1,500.00

($1,500)(0.07) = $105.00 = broker's fee

20. (150 ~~ft~~) $\left(\frac{\$90.00}{\text{ft}}\right)$ = $13,500

($4,500) (0.10) = $450.00

$13,500 - $4,500 = $9,000

2 1/2% = 0.025

($9,000)(0.025) = $225.00

$450.00 + $225.00 = $675.00 = total broker's fee

Complete solutions to B problems.

21. ($400.00)(12) = $4,800.00

($4,800.00) (0.075) = $360.00 = total due

22. ($35,000)(0.06) = $2,100.00 = total brokerage fee

$\frac{\$2,100}{2}$ = $1,050

($2,100) (0.10) = $210.00 = listing fee

$1,050 = $210.00 = $840.00 = selling fee

PERCENT
DISCOUNT
Level II

A. Problems with solutions.

1. Dean Brown sold a home for $21,500. The buyer is applying for an insured Deed and Trust Loan. The necessary insurance ratio is as follows:

   97% on first $15,000
   90% on next $10,000
   80% of the balance to a maximum of $33,000

   An investor is requiring a discount of 4.5%. How much will the Seller have to pay to the investor in order for the loan to be closed?

   Solution:

$21,000 - $15,000 = $6,500.
($15,000 (.97) = $14,550.
($6500) (.90) = $ 5850.
$20,400
.045
$918

2. Brad Turner had a $7200 balance on his home. The buyer said he would pruchase the contract if the seller would discount it 10 points. What is the value of the discount requested? (note: points are the same as percentages)

   Solution:

($7200)(.10) = $720

3. An F.H.A. insured loan of $15,500 will require a discount of 4 3/4 points, which will be deducted fron the amount given to the borrower. What is the actual amount of cash to be advanced by the lender?

   Solution:

($15,500) (.0475) = $736.25

$15,500 - $736.25 = $14,763.75

PERCENT
DISCOUNT
Level II

B. Problems without solutions.

4. A lender agreed to grant a mortgage loan of 80% value at a discount of 6 points. What is the dollar value of the discount paid to the lender if the sales price was $14,000?

5. If a lender requires a discount of 5 1/2 points on a loan of $11,500 and the discount would be subtracted from the sellers $10,000 equity, what is the net sum the seller will receive from the sale of his home?

6. On a loan, the lender advises he will loan 70% of market value, with a loan fee of 2% of loan and discount quote of 8% of net funds disbursed. What is the discount in dollars and cents if the home has a fair market value of $10,000?

PERCENT
DISCOUNT
Level II

7. There is an F.H.A. insurable value appraisal on a home for $16,000. F.H.A. will insure the loan as follows: 97% of the first $13,500 and 90% of the balance. The investor who is going to make the loan requires a 4 point discount. What is the value of the discount the seller must pay?

8. Robert Ladd borrowed $20,500 on an apartment and the investor requires a 7 point discount. What is the sellers share of the discount if they each agree to pay half?

9. Sally Fisher is agreeing to discount a mortgage by 9 points. If the value of the mortgage was $18,720, what would be the amount received for the mortgage after the discount?

PERCENT
DISCOUNT
Level II

B. Problems without solutions.

10. If you sign a note at a bank for $18,250 and the bank requires a 5 1/2 point discount, what will be the actual amount of cash given you?

11. An F.H.A. conditional loan commitment is made in the amount of $10,600. The loan section that the borrower will apply under will permit a 97% value loan, after a deduction of closing costs and reserve are made. The closing costs and reserve amount to $490. The lender is charging a 6 point discount. What will be the dollar amount of discount?

PERCENT
DISCOUNT
Level II

B. Problems without Solutions

12. There is an F.H.A. conditional committment on a duplex which is not going to be occupied by owners, for $24,750. On closing the loan the mortgage banker collected a 4% discount. The F.H.A. insured value rates are: 97% on first $15,000; 90% on next $5000; an 75% on balance. Because the owner is not going to live on the property he can borrow only 85% of the total insured loan. How much discount will the borrower have to pay?

13. A mortgage company is required a discount of 7.8% on a $24,750 mortgage. What is the discount?

PERCENT
DISCOUNT
Level II

B. Problems without solutions.

14. The discount quote is 2 points for each 1/4 of 1% difference between the fixed rate of interest on the contract and the open market rate. If the fixed rate is 7 1/2 and the open market is 8 1/4, how many points discount would be required?

15. A savings and loan will grant 80% loan on the appraised value of the home. The borrower asks for an interest rate 3/4% below the current market rate. The loan officer will do that if the borrower will pay a 6% discount, based on the actual amount borrowed. What would be the discount amount if the property was assessed at $22,000?

PERCENT
DISCOUNT
Level II

Complete solutions to B problems.

4. ($14,000)(0.80) = $11,200

   ($11,200) (0.06) = $672.00

5. ($11,500) (0.055) = $632.50

   $10,000 - $632.50 = $9,367.500

6. ($10,000)(0.70) = $7,000

   ($7,000)(0.02) = $140

   $7,000 - $140 = $6860

   ($6860)(.08) = $548.80

7. $16,000 - $13,500 = $2500

   ($13,500)(0.97) = $13,095

   ($2,500)(0.90) = $ 2,250

   ($15,345) (.04) = $613.80

8. ($20,500) (.07) = $1435

   $1435/2 = $717.50

9. ($18,720)(.09) = $1684.80

   $18,720 - $1684.80 = $17,035.20

10. ($18,250) (.055) = $1003.75

    $ 18,250 - $1003.75 = $17,246.25

11. $10,600 - $490 = $10110.00

    ($10,110)(0.06) = $606.60

12. $24,750 - $15,000 = $9,750

    $9,750 - $5,000 = $4,750

    ($15,000 (0.97) = $14,550.00

    ($5,000) (0.90) = $4,500.00

    ($4,750)(0.75) = $3,562.50

    ($22,612.50) (0.85) = $19,200.63

    ($19,200.63) (0.04) = $768.83

PERCENT
DISCOUNT
Level II

Complete solutions to B problems, continued.

13. ($24,750) (.078) = $1930.50

14. Difference between 8 1/4 and 7 1/2

= 8 1/4 - 7 1/2

= 3/4

Converting to quarters = (3/4) ÷ (1/4) = 3 quarters

Discount required = (3 quarters) (2 pts/~~quarter~~)

= 6 points

15. ($22,000) (0.80) = $17,600

($17,600) (0.06) = $1,056

A. Problems with solutions.

1. The amount of a loan is $500. and the annual interest rate is 3%. How much interest will be paid on the loan in one year?
(P)(R)(T) = I

Solution:

$$I = (\$500.00)\ (0.03)\ (1)$$

$$= \$15.00$$

2. If a loan is made for $21,500 and the annual interest rate is 4 1/2%, what is the amount of the semi-annual interest payment?

Solution:

$$I = (\$21,500)(0.045)(1)$$

$$= \$967.50 \text{ annual interest}$$

$$\frac{\$967.50}{2} = \$483.75 = \text{semi-annual interest}$$

3. Find the interest on a savings deposit of $4000 from Oct. 1,1975 to April 1, 1977 at the rate of 6% interest per year.

Solution:

1 Oct., 1975, to 1 April, 1977 is 1 year, 6 months

$$I = (\$4,000)\ (0.06)\ (1.5)$$

$$= \$360.00$$

B. Problems without solutions.

4. (a) What is six months compound interest on $5,000 if the annual interest rate is 10% (interest is figured semi-annually).

(b) What is the total interest paid for one year?

PERCENT
INTEREST
Level I

B. Problems without solutions, continued.

5. There is a balance of $4,000 due on a contract that requires monthly payments of $85 plus interest at 6% per year, payable monthly. What would the total payment be the fifth month?

6. Mr. Barns borrowed $2400 at 8% interest. At the end of six months he paid the interest due and $600 on the principal. He continued paying $600 plus interest due at the end of each 6-month period until the loan was repaid. What was the total amount of interest he paid?

7. The mortgage balance is $6,000; the monthly payments are $85 per month for principal, interest, tax and insurance reserve. It is estimated that the tax and insurance cost $408 per year. What is the principal amount owing after the first monthly payment has been applied, if the annual interest charge is 8 1/4% per annum?

PERCENT
INTEREST
Level I

b. Problems without solutions.

8. What is the simple interest on $985 for 3 years 10 months 20 days at 6 1/2% per year interest?

9. On a mortgage loan of $7500 and interest of 8 1/2%, what is the quarterly interest payment?

10. Bill Maxley borrowed $1000 at 0.06 interest. At the end of each year for 5 years, he paid the interest on the loan and $200 on the principal. How much interest did he pay on the loan?

11. How long will it take to pay off a note for $2000 at $20 per month plus interest at 7 7/8% per annum?

PERCENT
INTEREST
Level I

B. Problems without solutions.

12. What is the interest on $8750 at 9% for 7 months 15 days?

13. There is a balance of $6000 due on a contract that requires payments of $60 plus interest at 5% per year, payable monthly. What would be the total monthly payment for the first months?

14. Mr. Jones borrowed $2000 on a savings pass book loan at 5 1/2% interest. The loan was repaid at the rate of $400 a year on the principal, plus the interest. What was the total amount of interest paid?

15. A loan of $1000 is granted for 3/4 of a year at 7 1/2% per annum. What total amount would be paid to retire the loan?

Complete solutions to B problems.

4. (a) ($5,000)(0.10) = $500.00 = interest per year

$\frac{\$500.00}{2}$ = $250.00 semi-annual interest

(b) $5,000 + $250.00 = $5,250.00

($5,250)(0.10) = $525.00 interest per year

5. The 4 monthly payments of $85 total $340,00

$4,000 - $340.00 = $3,660 = new principal

(3,660)(0.06) = $219.60

$\frac{\$219.60}{12}$ = $18.30 = interest for the 5th month

$85.00 + $18.30 = $103.30 = total payment

6. ($2,400)(0.08) = $192.00

$\frac{\$192.00}{2}$ = $96.00 = 1st 6 months interest

$2,400 - $600.00 = $1,800.00

($1,800.00)(0.08) = $144.00

$\frac{\$144.00}{2}$ = $72.00 = 2nd 6 months interest

$1,800.00 - $600.00 = $1200.00

($ 1,200.00) (0.08) = $96.00

$\frac{\$ 96.00}{2}$ = $48.00 = 3rd 6 months interest.

$ 1,200.00 - $600.00 = $600.00

($600)(0.08) = $48.00

$\frac{\$48.00}{2}$ = $24.00 = 4th 6 months interest

Total = $96.00
$72.00
$48.00
$24.00
$240.00

PERCENT
INTEREST
Level 1

Complete solutions to B problems, continued.

7. $\frac{\$408.00}{12} = \$34.00$

$\$85.00 - \$34.00 = \$51.00$ = principal and interest

$(\$6,000)(0.0825) = \$495.00$

$\frac{\$495.00}{12} = \$41.25$

$\$51.00 - \$41.25 = \$9.75$

$\$6,000 - \$9.75 = \$5,990.25$

8. $(\$985,00)(0.065) = \$64.03$ = interest per year

$\left(\frac{\$64.03}{\text{year}}\right)(3.89\ \text{year}) = \$249.06$

9. (principal)(interest rate)(time) = interest

$I = (\$7,500)(0.085)(0.25)$

$= \$159.38$

10. $(\$1,000)(0.06) = \$60.00$ = first interest payment

$\$1,000 - \$200.00 = \$800.00$

$(\$800.00)(0.06) = \$48.00$ = second interest payment

$\$800.00 - \$200.00 = \$600.00$

$(\$600.00)(0.06) = \$36.00$ = third interest payment

$\$600.00 - \$200.00 = \$400.00$

$(\$400.00)(0.06) = \$24.00$ = fourth interest payment

$\$400.00 - \$200.00 = \$200.00$

$(200.00)(0.06) = \$12.00$ = fifth interest payment

$\$60.00 + \$48.00 + \$36.00 + \$24.00 + \$12.00 = \$180.00$

Complete solutions to B problems, continued.

11. $\frac{\$2{,}000}{\$20/\text{month}}$ = 100 months

12. ($8,750)(0.09)(1) = $787.50 = yearly interest

$\frac{\$787.50}{12}$ = $65.63 monthly interest

($65.63)(7.5) = $492.19

13. ($6,000)(0.05) = $300.00

$\frac{\$300.00}{12}$ = $25.00 = monthly interest

$60.00 + $25.00 = $85.00

14. ($2,000)(0.055) = $110.00 = first years interest

$2,000 - $400.00 = $1,600.00

($1,600.00)(0.055) = $88.00 = second years interest

$1,600 - $400.00 = $1,200.00

($1,200.00)(0.055) = $66.00 = third years interest

$1,200.00 - $400.00 = $800.00

($800.00)(0.055) = $44.00 = fourth years interest

$800.00 - $400.00 = $400.00

($400.00)(0.055) = $22.00 = fifth years interest

Total interest = $110.00
88.00
66.00
44.00
+ 22.00
Total interest = $330.00

Complete solutions to B problems, continued.

15. ($1,000.00) (0.075) = $75.00 = interest per year

$\frac{\$75.00}{12}$ = $ 6.25 = interest per month

3/4 of a year = 9 months

($6.25)(9) = $56.25

$1,000 + $56.25 = $1,056.25

A. Problems with solutions.

1. A $5000 lot was assessed at 70% and has a tax rate of $3.97 per $100.

   a) What would be the annual amount of taxes on this lot?
   b) If the property sold Dec. 1 what would be the value of unused taxes for the fiscal tax year July 1 to June 30?

Solution

a) ($500)(.70) = $3,500 = assessed value

$$(\$3{,}500)\left(\frac{\$3.97}{\$100.00}\right) = \$138.95 = \text{taxes per year}$$

b) $\frac{\$138.95}{12} = \$11.58 = \text{taxes per month}$

1 Dec. to 30 June = 7 months

($11.58)(7) = $81.05

2. A home valued at $15,750 is assessed 75% of market value and the millage rate is 82 1/4.

   a) What is the assessed tax?

   b) If the property is sold May 15 and the fiscal tax year is July 1 to June 30, what amount would the seller be credited.

a) ($15,750)(.75) = $11,812.5 = assessed value

($11,812.5)(.08225) = $971.58 = assed tax

b) 15 May to 30 June = 1.5 months

$\frac{\$971.58}{12} = \$80.96 = \text{taxes per month}$

($80.96) (1.5) = $121.45

B. Problems without solutions.

3. An apartment complex is assessed 60% of its $90,000 value.
   a) What are the annual taxes at $15 per thousand?
   b) What are the annual taxes at 150 mills?

4. A home valued at $10,000 has an assessment of 40% and the tax rate is 6 1/2¢ per dollar, on the assessed value. What are the real property taxes?

5. Mrs. McCarthy has a home valued at $13,500 and a tax ratio of 75%. The millage rate is 45 mills. What are the bi-monthly taxes.

B. Problems without solutions.

6. Tax is assessed on the true cash value (TCV) of a home worth $29,500. The following levies have approved tax rates per $1000 of assessed value of :

City Government	$7.85
Fire Protection	2.10
Water District	.85
School	18.50
Miscellaneous	2.25
	$31.55

What are the annual property taxes?

7. Property valued at $18,575 is assessed at 75% of its value and taxed at the rate of 27 1/2 mills.

a) What are the taxes on the property?
b) If sold June 1 what is the value of the prepaid tax based on a calendar year?

B. Problems without solutions.

8. A home with a fair market value of $21,750 has a tax ratio of 60% and a tax rate of $4.50 per $100. What is the monthly tax expense?

9. A lot has an assessed value of $2500 and a millage rate of 50 mills.

   a) What are the taxes?

   b) If a $19,500 house was built on the lot what would the taxes amount to if the tax assessment on the house is 89%?

B. Problems without solutions.

10. A home worth $15,500 has a tax ratio of 30%.

    a) What is the assessed value?
    b) The annual tax rate is $32.50 per $1000 of assessed value. What is the monthly property tax?

11. A home with a true cash value (TCV) of $36,000 was assessed at the TCV. The county had a millage rate of 36 mills and the city had a rate of 21 mills. What is the annual Real taxes?

B. Problems without solutions.

12. A house has a fair market value of $25,000. The tax ratio is 85% of fair market value and the tax rate is $4.75 per $100 of assessed value.

    a) What is the monthly tax on the property?
    b) What is the bi-monthly tax?

13. Property valued at $82,000 is assessed at 80% of its value. The annual tax rate is 75 mills.
    a) What are the taxes on the property?
    b) If the property sale closed March 1 what would be the amount of pre-paid taxes based on the calendar year?

14. A house has a fair market value of $14,700. The tax ratio is 75%.

    a) What is the assessed value?
    b) What is the semi-yearly tax if the tax rate is 69 1/2 mills?

B. Problems without solutions.

15. A home has a fair market value of $12,000. The tax rate is $4.50 per $1000 of the assessed value. The tax ratio is 30%. What are the annual taxes?

Complete solutions to B problems.

3. a) ($90,000)(.60) = $54,000 = assessed value

$$\frac{\$54{,}000}{\$1000} = 54.00$$

(54)($15) = $810.00

b) ($54,000)(.150) = $8,100

4. ($10.000)(.40) = $4,000

($4,000)(.065) = $260.00

5. ($13,500)(.75) = $10,125

($10,125)(.045) = $455,63 = yearly tax

$$\frac{\$455.63}{12} = \$37.97 = \text{taxes per month}$$

($37.97)(2) = $75.94 = bi- monthly tax.

6. $$\frac{\$29{,}500}{\$1{,}000} = 29.5$$

(29.5)($31.55) = $930.73

7. a) ($18,575)(.75) = $13,931.25 = assessed value

($13,931.25)(0.0375) = $522.42

b) 1 June to 30 Dec = 7 months

$$\frac{\$522.42}{12} = \$43.54 = \text{taxes per month}$$

($43.54)(7) = $304.75

8. ($21,750)(0.60) = $13,050.00

$$\frac{\$13050}{\$100} = 130.50$$

(130.50)($4.50) = $587.25

Complete solutions to B problems.

9. a) ($2,500)(0.050) = $125.00

b) ($19,500)(0.89) = $17,355.00

($17,355)(.050) = $867.75 = house taxes

$867.75 + $125.00 = $992.75

10. a) ($15,500)(0.30) = $4,650

b) $\frac{\$4,650}{\$1000}$ = $4.65

(4.65)($32.50) = $151.13

$\frac{\$151.13}{12}$ = $12.59

11. ($36,000)(0.036) = $1,296.00

($36,000)(0.021) = $756.00

Total = $2,052

12. a) ($25,000)(0.85) = $21,250.00

$\frac{\$21,250}{\$100}$ = $212.50

($212.50)($4.75) = $1,009.38

$\frac{\$1,009.38}{12}$ = $84.11

b) ($84.11)(2) = $168.23

13. a) ($82,000)(.80) = $65,600

($65,600)(0.075) = $4920.00

b) 1 March to 31 Dec. = 10 months

$\frac{\$4,920.00}{12}$ = $410.00 = taxes per month

($410.00)(10) = $4,100

Complete solutions to B problems.

14. a) ($14,700)(0.750) = $11,025.00

b) ($11,025)(0.0695) = $766.24

$$\frac{\$766.24}{2} = \$383.12$$

15. ($12,000)(0.30) = $3,600.00

$$\frac{\$3,600}{\$1000} = 3.6$$

(3.6)($40.00) = $144.00

PERCENT
PRORATION
Level II

A. Problems with solutions.

1 A house valued at $10,000 was insured against fire for 80% of its value. The rate was 60¢ per 100 value for a three year period.
   a) What would be the unearned premium if the policy had a one year remaining term?
   b) What would be the unearned premium if the policy had a 2 year 4 month remaining term?

Solution:

a) ($10,000)(0.80) = $8,000 = insured amound

$$\left(\frac{\$.60}{\$100.}\right)(\$8,000) = \$48.00 \text{ for 3 years}$$

$$\frac{\$48.00}{3} = \$16.00 \text{ for 1 year}$$

b) (2 1/3 year)($16/year) = $37.33

2. A home sold for $24,000 on Feb 1, 1974. The property was insured for 3 years, beginning Sept. 1, 1972, at 90% of its selling price. The insurance rate is 54¢ per $100 for 3 years.

   a) What was the unearned premium charged the purchaser?
   b) What is the value of the prepaid taxes if they are paid in full in the amount of $579.12 for the calendar year?

Solution:

a) ($24,000.00)(0.90) = $21,600 = insured amount

$$\left(\frac{\$.54}{\$100.00}\right)(\$21,600) = \$116.64 \text{ for 3 years}$$

$$\frac{\$116.64}{3} = \$38.88 \text{ for 1 year}$$

The policy was for 3 years , so it runs through 1 Sept. 1975, but the house was sold on 1 Feb, 1974, leaving one year and seven months to be paid, or 1 and 7/12 years.

$$\left(\frac{\$38.88}{\text{year}}\right)\left(\frac{19}{12}\text{ year}\right) = \$61.56$$

b)

1 Feb through 31 Dec. = 11 months

$$\frac{\$579.12}{12 \text{ months}} = \frac{\$48.26 \text{ taxes}}{\text{month}}$$

$$\left(\frac{\$48.26}{\text{month}}\right)(11 \text{ months}) = \$530.86$$

B. Problems without solutions.

3. On June 15th of this year you purchased a home iwth a $4500 mortgage at 7 1/2% interest paid to Dec. 15 of last year. What credit will you get from this?

4. You borrow $3,400 on a note April 15th of this year and promise to repay it January 15th of next year. The simple interest rate is 10%. What would be the total interest charge?

5. A loan made March 15 was repaid Nov 25.

   a) For how many months and days would the borrower be charged?
   b) If the sum borrowed was $29,750 and the interest rate was 8 3/4% what is the total interest charge?

Complete solutions to B problems.

3. 15 June to 15 Dec. = 6 months

($4,500.00)(.075) = $337.5 yearly interest

$\left(\frac{\$337.50}{\text{year}}\right)$ (.5 year) = $ 168.75

4. 15 April to 15 Jan. = 9 months

($3,400)(.10) = $340.00 yearly interest

$\left(\frac{\$340.00}{\text{year}}\right)$ (9/12 year) = $255.00

5. a) 8 months, 10 days

b) ($29,750)(.0875) = $2603.13 yearly interest

monthly interest = $\frac{\$2603.13}{12}$ = $216.927

$\left(\frac{\$216.927}{\text{month}}\right)$ (8 1/3 months) = $1,807.73